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DEPARTMENT OF THE ARMY FIELD MANUAL

**155-MM GUN M53, SELF-PROPELLED
AND 8-INCH HOWITZER M55
SELF-PROPELLED**



HEADQUARTERS, DEPARTMENT OF THE ARMY

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 28 September, 1964

155-MM GUN M53, SELF-PROPELLED AND 8-INCH HOWITZER M55, SELF-PROPELLED

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✓* This manual supersedes FM 6-93, 3 July 1957.

CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders and chiefs of sections in developing 8-inch howitzer M55, and 155-mm gun M53, self-propelled sections into teams that will operate effectively in battle.

b. This manual prescribes the duties of the section personnel in—

- (1) Section drill.
- (2) Preparation for firing and traveling.
- (3) Firing.
- (4) Tests and adjustments.
- (5) Maintenance and inspections.
- (6) Decontamination of equipment.
- (7) Destruction of equipment.

c. This manual is applicable to both nuclear and nonnuclear warfare without modification.

d. To improve this manual, users are encouraged to submit recommended changes and comments. The procedure is as follows:

- (1) Key comments to the specific page, paragraph and line.
- (2) Include supporting reasons with each comment.
- (3) Send direct to U. S. Army Artillery and Missile School, ATTN: AKPSIPL, Fort Sill, Okla.

2. Definition of Terms

a. *Section.* Tables of organization and equipment (TOE's) prescribe the personnel and equipment comprising each section of a battery (figs. 1-3). In this manual the term section is often used to designate only the personnel required to serve the weapon and its equipment.

b. *Front.* The front of a section is the direction in which the muzzle of the howitzer (gun) points.

c. *Right (Left).* The direction right (left)

is the right (left) of one facing to the front.

d. *In Battery.* A howitzer (gun) is said to be in battery when the recoiling parts are in the normal firing position.

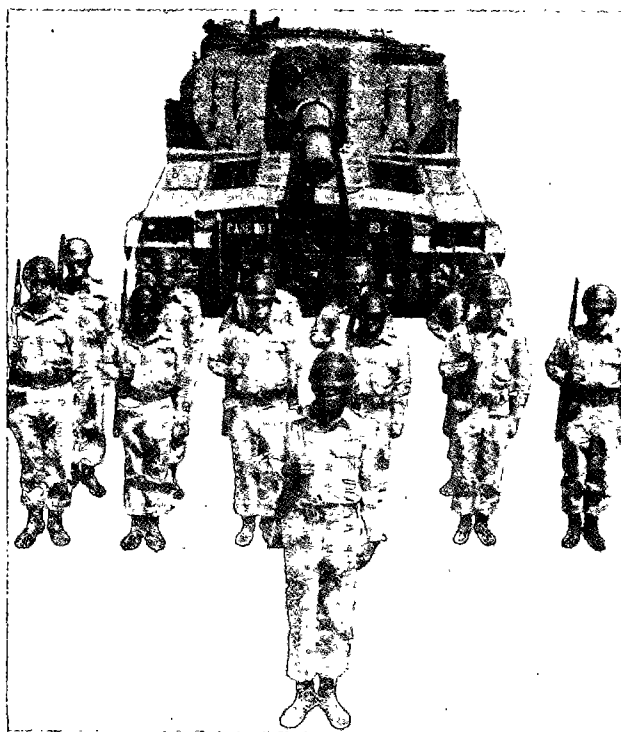


Figure 1. 155-mm gun M53, self-propelled, and section personnel.

3. Description of Equipment

To insure proper use of the motor carriage and to avoid accidents caused by exceeding its capabilities and limitations, all members of the section should be familiar with the performance characteristics shown in figure 4. For further details pertaining to full-track vehicle capabilities and combat driving, see TM 21-306.



Figure 2. 8-inch howitzer M55, self-propelled, and section personnel.

4. References

Publications pertaining to the 8-inch howitzer M55 and 155-mm gun M53, self-propelled; and auxiliary equipment, covering related matters which are not discussed in detail in this manual, are listed in the appendix.

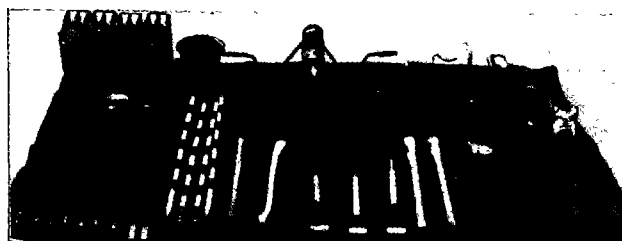


Figure 3. A method of displaying section equipment.

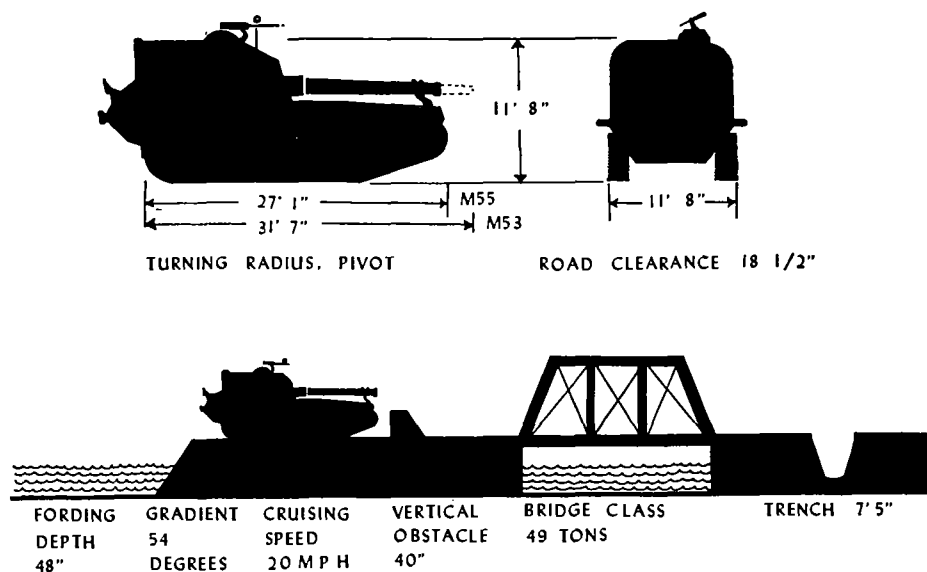


Figure 4. Performance characteristics of the motor carriage, 155-mm gun M53, self-propelled, or the 8-inch howitzer M55, self-propelled.

CHAPTER 2

ORGANIZATION

5. Composition of the Howitzer Section

a. The howitzer (gun) section consists of section personnel; an 8-inch howitzer M55, self-propelled of a 155-mm gun M53 self-propelled; a 5-ton truck; an ammunition trailer; and auxiliary equipment (figs. 1 and 2).

b. The personnel of the 8-inch howitzer section and the 155-mm gun section consists of—

- (1) A chief of section (CS).
- (2) A gunner (G).
- (3) An assistant gunner (AG).
- (4) Eight cannoneers, numbered 1 through 8.
- (5) A motor carriage driver (MD).
- (6) A section vehicle driver (SD).

c. Section equipment is listed in appropriate TOE's (app.).

6. General Duties of Personnel

a. *Chief of Section.* The chief of section is the noncommissioned officer in command of the section and as such, is responsible to the battery executive for—

- (1) Training and efficiency of personnel.
- (2) Performance of duties in section drill, duties in firing, tests and adjustment of sighting and fire control equipment, and inspection and maintenance of all section equipment, including the performance of scheduled preventive maintenance service on the motor carriage and section vehicle.

(3) Observation of safety precautions.

(4) Preparation of field fortifications for protection of equipment, ammunition, and personnel.

(5) Camouflage discipline; local security; and chemical, biological, and radiological (CBR) warfare security discipline.

(6) Maintenance of the Equipment Log Book (TM 38-750).

(7) Police of the section area.

b. *Gunner.* The gunner is the principal assistant to the chief of section in performing the duties specified in *a* above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

c. *Assistant Gunner.* The assistant gunner assists the gunner in performing his duties and, in an emergency, acts as the gunner. The assistant gunner's specific duties are prescribed in appropriate chapters of this manual.

d. *Cannoneers.* Cannoneers perform the duties listed in this manual and any other duties assigned by the chief of section.

e. *Drivers.* The drivers' primary duties are driving their respective vehicles and performing preventive maintenance. They also perform the duties prescribed by this manual and by the technical manuals pertaining to their vehicles, and other duties assigned by the chief of section. These duties can include substituting for any member of the section in firing.

CHAPTER 3

SECTION DRILL

Section I. GENERAL

7. Objective

The objective of section drill is the attainment of efficiency—maximum precision coupled with high speed.

8. Instructions

a. Adherence to drills prescribed in this manual is necessary to develop maximum efficiency and to prevent injury to personnel and damage to equipment. Section drill must be conducted in silence, except for commands and reports. The section must be drilled until reactions to commands are automatic, rapid, and efficient.

b. Errors are corrected immediately. Each member of the section must be impressed with

the importance of reporting promptly to the chief of section any errors discovered before or after the command to fire has been given. The chief of section will report errors immediately to the executive.

c. Battery officers supervise the drill to insure that instructions are carried out and that maximum efficiency is obtained.

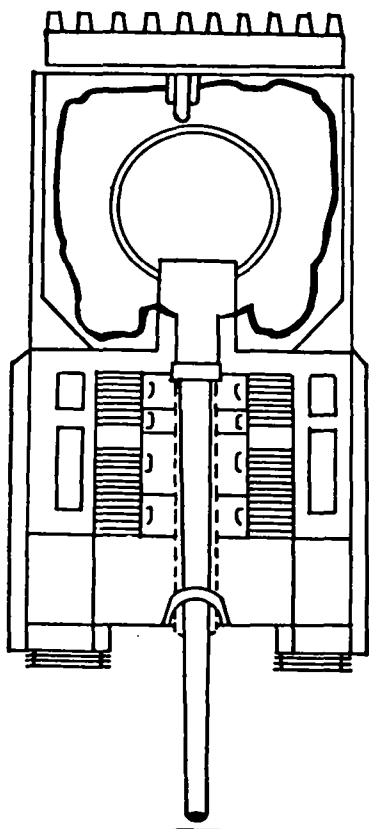
d. Duties should be rotated during training so that each member of the howitzer (gun) section can perform all the duties within the section. In addition, battery overhead personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill in order that they will be capable of functioning efficiently with a howitzer (gun) section if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

9. To Form the Section

a. To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank, at close interval, centered on and facing the chief of section at a distance of 3 paces. Higher numbered cannoneers, if present, form in order between No. 8 and the motor carriage driver. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. At the first formation for a drill or exercise, the caution "As howitzer

(gun) section(s)" precedes the command. The commands are FALL IN, or 1. IN FRONT (REAR) OF YOUR PIECE(S), 2. FALL IN, or 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Execution is as follows: The section moves at double time and forms at close interval, at attention, guiding on the gunner. The driver of the section vehicle is to the left of the motor carriage driver and is the last in line. To execute 1. IN REAR OF YOUR PIECE, 2. FALL IN, the section falls in as shown in figure 5.



2 Paces

3 Paces

Figure 5. Formation of the section.

b. *To Call Off.* The section being in formation, the command is CALL OFF. At the command, all personnel in ranks, except the gunner execute eyes right. The section then calls off in sequence; for example, "Gunner," "Assistant Gunner," "1," "2," "3," "4," "5," "6," "7," "8," "Driver," "Driver." Each man, except the gunner, turns his head smartly to the front as he calls out his designation.

10. To Post the Section

The command is 1. CANNONEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks, at a halt, or marching. All movements are executed at double time and are terminated at the position of attention. Higher numbered cannoneers, if present, take posts as prescribed by the chief of section.

a. *Dismounted.* The section moves to posts as shown in figure 6. All personnel are 2 feet outside the vehicles and facing the front.

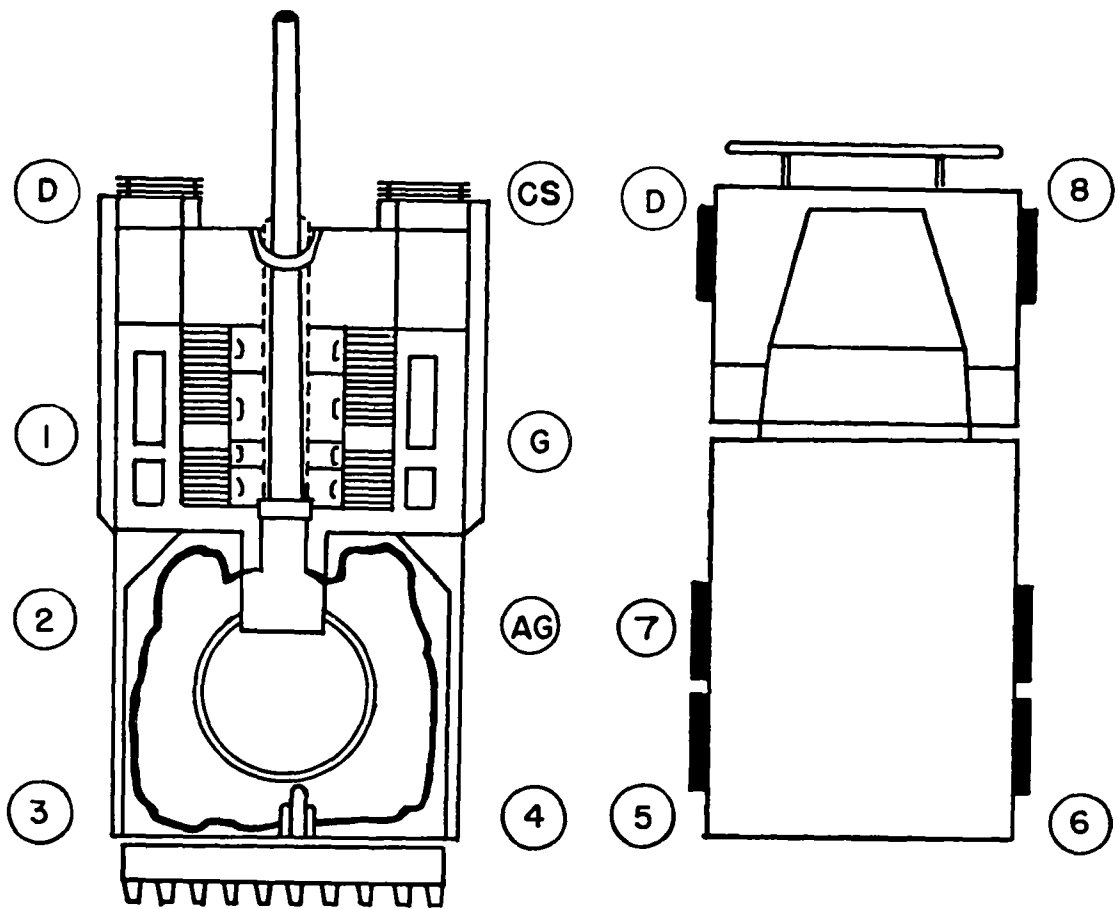


Figure 6. Posts of section dismounted.

b. *Prepared for Action.* The piece having been prepared for action, the section is posted as shown in figure 7. All personnel face to the front.

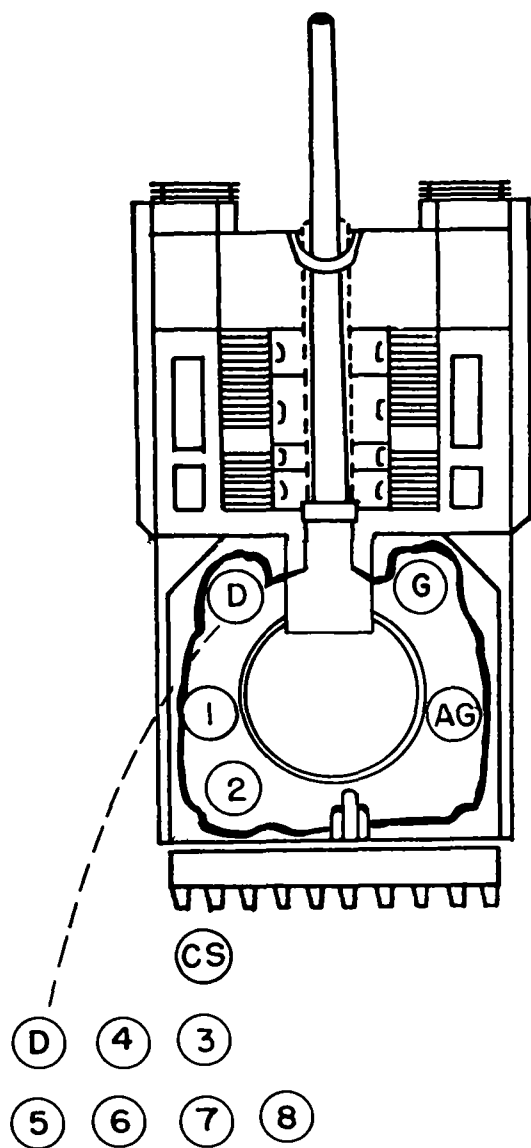


Figure 7. Posts of section prepared for action.

11. To Change Posts

To acquaint the members of the section with all duties and to lend variety to drill, posts should be changed frequently. The section being *IN FORMATION* (fig. 5), the commands are 1. CHANGE POSTS, 2. MARCH, or 1. SECTION CHANGE POSTS, 2. MARCH.

a. At the command 1. CHANGE POSTS, 2. MARCH, all numbered cannoneers except No. 8 take two left steps, taking the position of the next higher numbered cannoneer. At the same time No. 8 moves at double time in rear of the rank to the post of the assistant gunner. All other members of the section stand fast.

b. At the command 1. SECTION CHANGE POSTS, 2. MARCH, all members of the section except the driver of the section vehicle (or the left most man in the rank) take two left steps. The driver of the section vehicle moves at double time in rear of the section and takes the post of the gunner.

12. To Mount

The commands are 1. PREPARE TO MOUNT, 2. MOUNT, or MOUNT.

a. At the preparatory command, the section moves at double time to the positions shown in figure 6. At the command of execution, all personnel mount as indicated in figure 8. The chief of section, driver of the motor carriage, gunner, assistant gunner, and No. 1, mount on the motor carriage. Likewise, at the command of execution, the driver of the section vehicle, and No's. 2, 3, 4, 5, 6, 7, and 8 mount into the section vehicle as shown in figure 9. If any members of the section are not to mount, their designation is announced with the caution, "Stand fast," given between the preparatory command and the command of execution. For execution. For example, 1. PREPARE TO MOUNT, DRIVERS STAND FAST, 2. MOUNT.

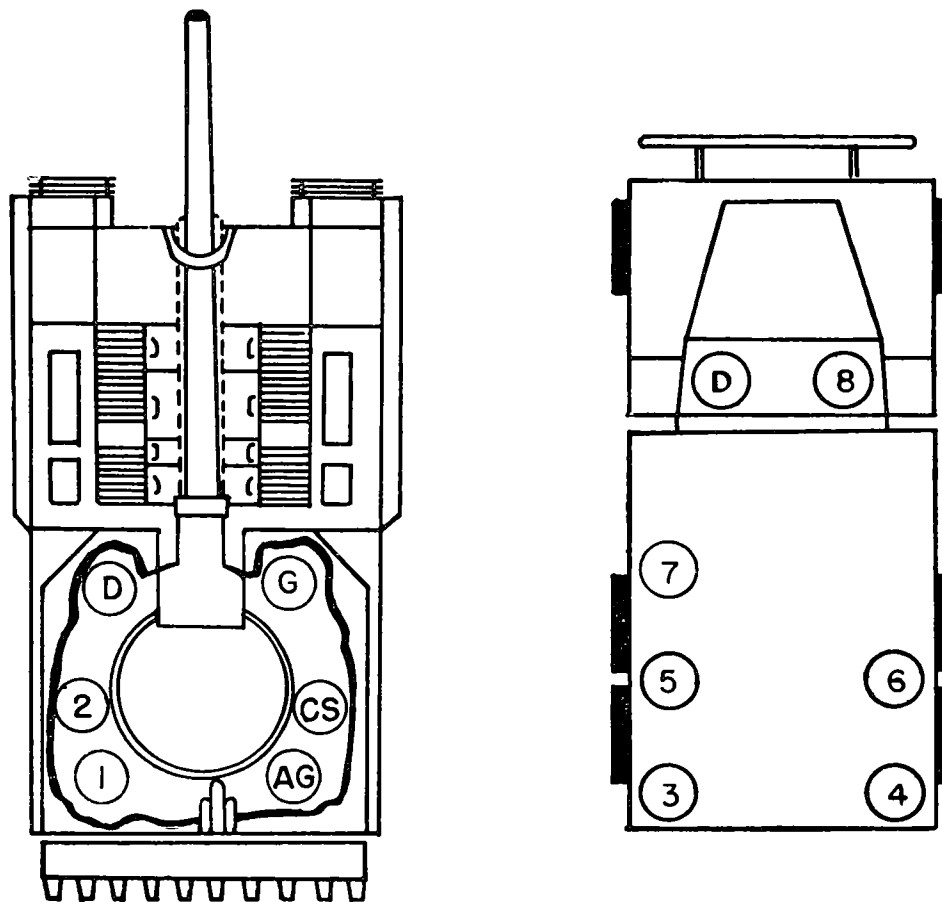


Figure 8. Section mounted.

b. If the command is MOUNT, the section mounts in the manner and order prescribed for the command 1. PREPARE TO MOUNT, 2. MOUNT. Dismounted posts are not taken.

13. To Dismount

The commands are 1. PREPARE TO DISMOUNT, 2. DISMOUNT, or DISMOUNT.

a. At the preparatory command, the personnel mounted in the section vehicle unlatch the tailgate of the vehicle and all members of the section assume positions from which they can dismount promptly. At the command of execution, they dismount and take the posts shown in figure 6 at double time.

b. If the command is simply DISMOUNT, the section executes all that is prescribed for the command 1. PREPARE TO DISMOUNT, 2 DISMOUNT.

14. To Fall Out

a. *At Drill.* When it is desired to give the personnel a rest from drill or to relieve them temporarily from *formation* or *post*, the command FALL OUT is given. The command may be given at any time and means that the section is to remain in the drill area.

b. *When Firing.* When firing has been suspended temporarily, but it is desired to have the section remain in the vicinity of the motor carriage, the command FALL OUT is given. Men stand clear of the piece to insure that settings and laying remain undisturbed. During these periods, the chief of section may direct the men to improve the position, to replenish ammunition, or to do other necessary work.

CHAPTER 4

PREPARING THE PIECE FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

15. General

The weapons of a battery will ordinarily be put into position individually under the direction of the executive and chiefs of section. A stake should be driven into the ground at a point where the center of each carriage is to be placed. Another stake should be placed in the direction of fire, 50 to 100 yards from the first stake, so that the driver of the motor carriage can point the tube at the far stake as he drives the vehicle into position over the first stake. Each vehicle is halted at its proper place by the chief of section. Hand signals for guiding the vehicle are found in FM 21-60, FM 55-30, and TM 21-306.

16. To Prepare for Action

a. The piece being in position or approaching it, the command is PREPARE FOR ACTION. Duties of individuals are given in table 1. Each man takes his post upon completion of his duties.

b. The piece normally will be partially prepared for action before reaching the firing position. The duties of the cannoneers in preparing for action are the same whether the piece is moving or halted, but only such operations as are practicable are carried out while moving. Immediately after the piece is established in position, preparation for action is completed without further command.

Table I. Duties in Preparing for Action
(Located in back of manual)

c. If PREPARE FOR ACTION has not been ordered before the piece is established in position, the command is habitually given by the chief of section as soon as the vehicle is halted in position. If preparation for action is not desired, the caution "Do not prepare for action" must be given.

Section II. PREPARATIONS FOR TRAVELING

17. March Order

To prepare to resume travel, the command is MARCH ORDER. Duties of individuals are given in table II. Each man takes his post upon completion of his duties.

When such a displacement is ordered, only those operations necessary for the movement of the motor carriage and the security of equipment are performed.

18. To Resume Firing in Another Position

a. If the piece is to be moved a short distance from where firing must be resumed promptly, the command MARCH ORDER is not given.

b. If the command MARCH ORDER is given while the weapon is prepared for travel as in *a* above, the operations pertaining to march order are completed.

Table II. Duties in Firing
(Located in back of manual)

CHAPTER 5

DUTIES IN FIRING, INDIRECT LAYING

Section I. GENERAL

19. Instructions

The general instructions in paragraphs 7 and 8 on the conduct of section drill apply equally to section drill in duties in firing by indirect laying. The sequence of duties performed in firing is shown in table III. For duties of the battery executive, see FM 6-40 and FM 6-140.

Table III. Duties in March Order
(Located in back of manual)

20. Duties of Individuals

In general, the duties of individuals in the section in indirect fire are given in *a* through *h* below.

a. The chief of section supervises and commands his section and is responsible that all duties of the section are performed properly, all commands executed, and all safety precautions observed.

b. The gunner sets the announced deflection and elevation, lays for direction and elevation, refers the piece, sets the horizontal equilibrator, activates and deactivates the power traversing and elevating mechanism, and fires the piece electrically.

c. Assistant gunner opens and closes the breech, inspects chamber and bore, operates rammer controls, and activates safety fire switch.

d. No. 1 operates ammunition hoist, inserts propellant into chamber, inserts primer, and removes spent primer.

e. No. 2 lowers and raises loading trough, swabs powder chamber after each round, and cleans obturator spindle vent, as required.

f. No. 3 fuzes projectiles, sets fuzes, and connects shot tongs to projectile.

g. No. 4 prepares propellant, cuts charges.

h. The No. 5 through No. 8 are responsible for the care and stowage of ammunition. They prepare the ammunition for firing.

i. The driver, motor carriage, shifts the carriage and assists in the preparation of ammunition as directed by the chief of section. He also starts and stops the auxiliary generator.

j. The driver, 5-ton truck, after his vehicle is unloaded, drives to the truck park, where he performs preventive maintenance operations unless directed otherwise by the chief of section.

Section II. DUTIES OF CHIEF OF SECTION

21. List of Duties

- a.* Indicates the aiming point to the gunner.
- b.* Measures the angle of site to the mask.
- c.* Follow fire commands.
- d.* Indicates when the piece is ready to be fired.
- e.* Gives the command to fire.

f. Reports errors and other unusual incidents of fire to the executive.

g. Records basic data.

h. Lays the piece for elevation, assisted by the assistant gunner, when the gunner's quadrant is used.

i. Measures the elevation.

j. Conducts prearranged fires.

k. Observes and checks frequently the functioning of the materiel.

l. Assigns duties when firing with reduced personnel.

m. Verifies the adjustment of the sighting and fire control equipment.

n. Controls the movement of the motor carriage.

o. Checks, before it is restowed for traveling, all ammunition not fired that has been prepared for firing.

22. Indicates the Aiming Point to the Gunner

When an aiming point has been designated by the executive (FM 6-140), the chief of section will insure that he has properly identified the point designated. He will then indicate this point to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the panoramic telescope until the horizontal and vertical crosshairs are on the designated aiming point.

23. Measures the Angle of Site to the Mask

a. The command is MEASURE THE ANGLE OF SITE TO THE MASK. The chief of section, sighting along the lowest element of the bore, directs the gunner to traverse and elevate the tube until the line of sight just clears the crest at its highest point in the probable field of fire. The gunner then turns the elevation counter knob in the appropriate direction until the elevation level bubble is centered. The chief of section reads the elevation from the elevation counter dial and reports to the executive, "Sir, number (so-and-so), angle of site (so much)."

b. When the executive announces the minimum elevation and charge or the minimum elevation for each charge, the chief of section records the data in a notebook and directs the assistant gunner to chalk the information on a convenient place on the hull or on the section data board.

24. Follows Fire Commands

The chief of section will follow fire commands. He will repeat the commands as required.

25. Indicates When the Piece is Ready To Be Fired

When the executive can see arm signals made

by the chief of section, the chief of section will raise his right arm vertically as a signal that the piece is ready to be fired. He gives the signal as soon as the gunner calls "Ready." When arm signals cannot be seen, the chief of section reports orally to the executive, "Sir, number (so-and-so) ready."

26. Gives the Command to Fire

When No. 2 can see the arm signals made by the chief of section, the chief of section will give the command to fire by dropping his right arm sharply to his side. When his arm signals cannot be seen, he commands orally NO. (SO-AND-SO), FIRE. The chief of section will not give the signal or command to fire until all cannoneers are in their proper places.

27. Reports Errors and Other Unusual Incidents of Fire to the Executive

If the piece cannot be fired, the chief of section will promptly report that fact to the executive and the reasons therefor; for example, "Sir, number (so-and-so) out; misfire." When it is discovered that the piece has been fired with an error in laying, the chief of section will report that fact at once; for example, "Sir, number (so-and-so) fired 40 mills right." When the gunner reports that the aiming posts are out of alignment, the chief of section will report that fact and, during the next lull in firing, ask permission to realine them. Likewise, the chief of section promptly reports other unusual incidents that affect the service of the piece.

28. Records Basic Data

The chief of section will record data of a semipermanent nature in a notebook. These data include minimum elevations; aiming points used and their deflections; prearranged fires when section data sheets are not furnished; safety limits in elevation and deflection; date, hour, and number of rounds fired; and calibration and special corrections when appropriate.

29. Lays the Piece for Elevation When Gunner's Quadrant is Used

a. Although the normal method of laying for elevation is by use of the elevation counter,

the gunner's quadrant may be used to lay for elevation when a refinement greater than 1 mil is desired. The gunner's quadrant is also used to check the accuracy of the elevation counters. The command is QUADRANT (so much), USE GUNNER'S QUADRANT.

b. An elevation of quadrant 361.8, for example, is set on the gunner's quadrant as follows: The upper edge of the plunger plate is set opposite the 360 mark on the scale on the quadrant frame, and the micrometer on the arm is set to read 1.8. Care must be taken to use the same side of the quadrant in setting both the plunger plate and the micrometer.

c. When the announced elevation has been set on the gunner's quadrant, the piece has been loaded, and the breechblock has been closed, the gunner's quadrant is set on the leveling plates of the breech ring. The words *line of fire* must be at the bottom of the quadrant with the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale which he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the leveling plates parallel to the axis of the bore. *It is important that he take the same position and hold the quadrant in the same manner for each subsequent setting, so that in each case he will view the quadrant bubble from the same angle.*

d. The chief of section then directs the assistant gunner to elevate or depress the tube until the bubble is centered, being careful that the last motion is in the direction in which it is more difficult to turn the handwheel of the manual elevating mechanism. The chief of section cautions the assistant gunner when the bubble approaches the center, so that the final centering may be performed accurately.

30. Measures the Quadrant

At the command MEASURE THE QUADRANT, the piece having been laid, the chief of section directs the assistant gunner to check the leveling of the elevation quadrant mount. The chief of section then sets the micrometer of the gunner's quadrant at zero and places it on the leveling plates of the breech ring. He then—

a. Moves the plunger arm of the gunner's quadrant until the bubble passes to the end of the vial away from the plunger arm hinge.

b. Slowly lowers the plunger arm until the bubble just passes to the end of the vial toward the hinge.

c. Turns the micrometer until the bubble is accurately centered.

d. Removes the quadrant and reports the elevation setting to the nearest 0.1 mil as "Sir, No. (so-and-so), quadrant (so much)."

31. Conducts Prearranged Fires

When the execution of prearranged fires is ordered, the chief of section conducts the fire of his section in conformity with the prescribed data.

32. Observes and Checks Functioning of the Materiel

The chief of section closely observes the functioning of all parts of the materiel during firing. Before the piece is fired, he insures that the recoil and counterrecoil systems contain the proper amount of oil; thereafter he carefully observes the functioning of these systems. He promptly reports to the executive any evidence of malfunctioning (TM 9-2350-210-12).

33. Assigns Duties When Firing With Reduced Personnel

When the number of personnel serving the piece is temporarily reduced below that indicated in this manual, the chief of section will assign duties to best facilitate the service of the piece. Loss of cadremen, various details, and casualties will necessitate the section's operating with a reduced number of personnel to the extent that it is almost normal for section members to double up on duties. Around-the-clock firing will require the chief of section to divide the section into shifts to provide for relief.

34. Verifies the Adjustment of the Sighting and Fire Control Equipment

See TM 9-2350-210-12 for detailed instructions on testing and adjusting sighting and fire control equipment.

35. Controls the Movement of the Motor Carriage

When it is necessary to move the motor carriage, the chief of section instructs the driver to start the engine. He then controls the displacement of the motor carriage by hand signals or by oral instructions. To shift the carriage when a new direction of fire is designated, the motor carriage should be moved so that when the tube is pointed in the new direction and the spade is seated the panoramic telescope will be over its original position and the aiming posts will still be in alinement.

36. Checks, Before it Is Restored for Traveling, All Ammunition Not Fired That Has Been Prepared for Firing

The chief of section personally checks all ammunition not fired that has been prepared for firing before it is replaced in containers. He sees that powder increments prepared for firing are present in proper condition, are of the same lot number as the container, and are assembled in proper numerical order. He checks all time fuzes that have been set to see that they are reset to SAFE and that the eyebolt lifting plugs are reinstalled. The chief of section also insures that grommets are replaced on the rotating bands of projectiles.

Section III. DUTIES OF GUNNER

37. List of Duties

- a. Centers the cross-level bubbles on the panoramic telescope mount.
- b. Lays the piece for direction.
- c. Alines the aiming posts, assisted by No. 4.
- d. Lays the piece for elevation.
- e. Sets a common deflection to a common aiming point after the piece has been laid.
- f. Sets or changes deflection.
- g. Signals and/or calls "Ready."
- h. Refers the piece.
- i. Makes corrections for aiming post displacement.

38. Centers the Cross-Level Bubble on the Panoramic Telescope Mount (fig. 9)

The gunner centers the level bubbles on the telescope mount by operating the leveling knobs as part of preparing the sight for action. Once the bubbles are leveled, it should not be necessary to make further adjustments during firing. However, the level of the mount is verified before calling "Ready."

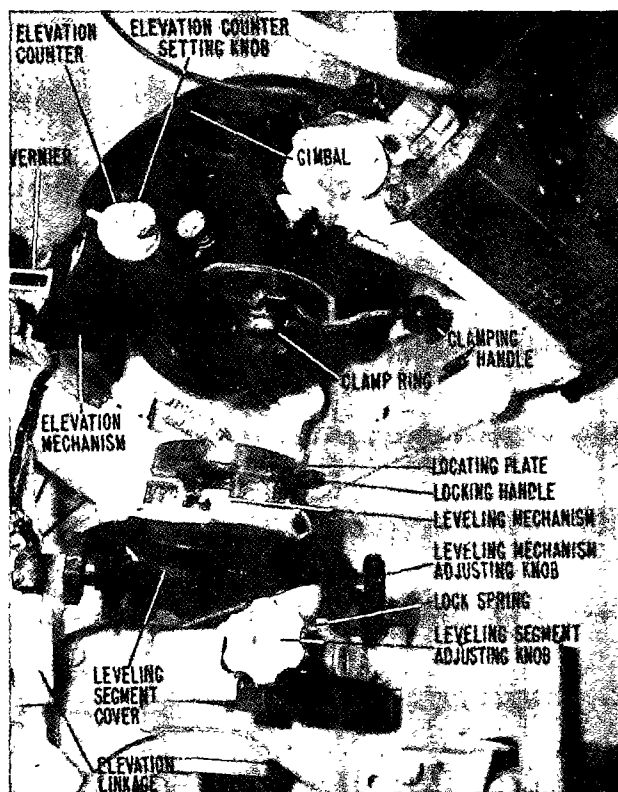


Figure 9. Telescope Mount M99

39. Lays the Piece for Direction (fig. 10)

The piece being in position, tube in the center of traverse—and not laid for direction, the executive commands number (SO-AND-SO) ADJUST AIMING POINT THIS INSTRUMENT. After the gunner has reported "Sir,

number (SO-AND-SO) aiming point identified, the executive commands NUMBER (SO-AND-SO) DEFLECTION (SO MUCH). The gunner sets the commanded deflection on the coarse azimuth scale, as viewed through the window, and the micrometer scale. He then directs the driver to move the motor carriage until the vertical crosshair of the sight reticle is approximately on the executive's aiming circle. The gunner then traverses the tube until the vertical crosshair of the telescope is exactly centered on the executive's aiming circle. He checks to insure that the bubbles are level and announces "Sir, number (so-and-so) ready for recheck." As additional deflection are announced by the executive, the gunner sets them on the coarse azimuth and micrometer scales and traverses the tube so that the vertical line of the sight is centered on the aiming circle. When the executive announces "number (so-and-so) is laid," the tube has been oriented and should not be traversed except on order of the executive.

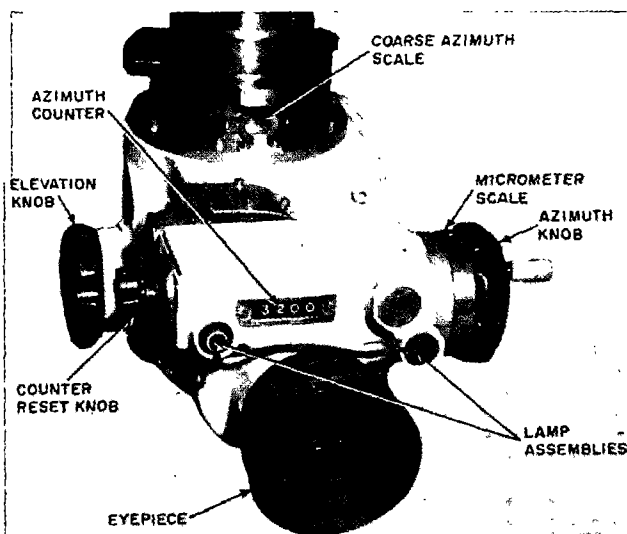


Figure 10. Panoramic Telescope M100

a. The *far* aiming post is placed at least 100 meters from the piece. This distance is the most desirable for accuracy, visibility, and control of the aiming post lights.

b. The *near* aiming post must be set up half-

way between the far post and the piece. Equal spacing is accomplished either by pacing, or by measuring with the panoramic telescope and using the aiming post as a stadia rod, or by using a wire or cord with the appropriate distances marked in a convenient manner.

c. If the aiming post is used as a stadia rod, the procedure is as follows:

- (1) Number 4 stands at the far aiming post and holds the upper section of an aiming post parallel to the ground and perpendicular to the line of sight.
- (2) The gunner measures the length of the aiming post in mils on the reticle of the panoramic telescope.
- (3) The gunner directs number 4 to move toward the piece and to emplace the near aiming post at a point where the upper section measures twice the number of mils it measured at the far aiming post.

d. For night use, the light on the far aiming post should be placed so that it appears several feet above the light on the near aiming post. The lights placed in this manner establish a vertical line for laying the howitzer.

e. Unit SOP will specify the deflection at which to place the aiming posts; however, placing the aiming posts at a deflection of 600 reduces misalignment and allows for maximum visibility.

f. Correction for displacement of the aiming posts from the vertical reticle of the panoramic telescope is discussed in table II.

40. Lays the Piece for Elevation (fig. 11)

The gunner sets the announced elevation on the elevation counter and then clamps the elevation counter setting knob in position with the clamping knob. He then elevates or depresses the tube in the direction indicated by the arrows in the elevation vernier until the indexes in the elevation vernier are alined. Final adjustment will be made manually in the direction of increasing resistance.

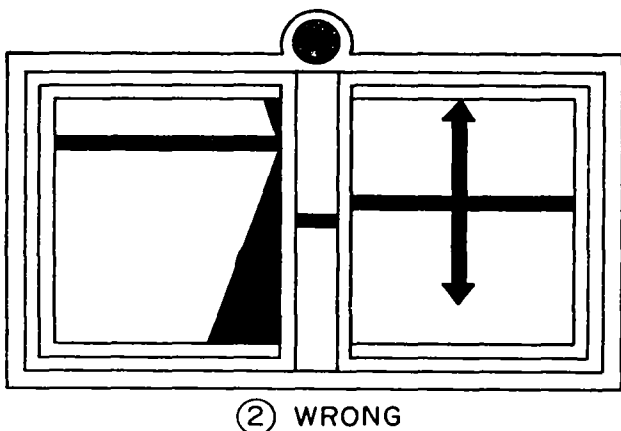
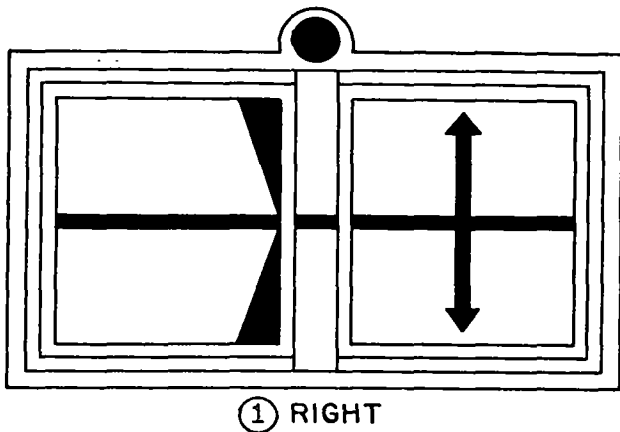


Figure 11. Alining elevation vernier indexes.

41. Sets a Common Deflection to a Common Aiming Point After the Piece has Been Laid

The piece having been laid, the executive may command AIMING POINT, CHURCH STEEPLE (or other point), REFER. At this command, without moving the tube, the gunner turns his sight to the aiming point and reports the deflection indicated. The executive then commands COMMON DEFLECTION 3200. At this command, the gunner depresses the azimuth counter reset knob and sets 3200 on the scale of the azimuth counter. He then makes a

final check to verify that the line of sight is still on the aiming point.

42. Sets or Changes the Deflection

The command is DEFLECTION (SO MUCH). If, for example, the command is DEFLECTION 3283, the gunner rotates the azimuth knob in the appropriate direction until 3283 is read on the azimuth counter. The gunner then traverses the piece until the vertical cross-hair of the reticle is on the left edge of the aiming posts or on a designated aiming point. Final motion for traversing is always from left to right.

43. Signals and/or Calls "READY"

After the piece has been loaded, primed, and laid in both direction and elevation and is ready to be fired, the gunner calls and/or signals "Ready," by shouting or raising his left arm to signify that the piece is ready to be fired.

44. Refers the Panoramic Telescope

The command is AIMING POINT THIS INSTRUMENT (OR OTHER POINT), REFER. Without disturbing the laying of the piece, the gunner turns the panoramic telescope until, with the elevation and cross-level bubbles centered, the vertical crosshair of the reticle is on the point designated. He then reports the deflection as read on the coarse azimuth and the micrometer scales to the executives, "Sir, number (so-and-so) deflection (so much)."

45. Makes Corrections for Aiming Post Displacement

For details of correcting for aiming post displacement, see paragraph 89.

46. Alines the Aiming Posts, Assisted By No. 4

The aiming posts are placed in alinement with the vertical reticle of the panoramic telescope as directed by the gunner.

Section IV. DUTIES OF ASSISTANT GUNNER, CANNONEERS AND DRIVER

47. Assistant Gunner's Duties

- a. Opens and closes the breech.
- b. Receives projectiles.
- c. Operates safety fire switch.

48. Opens and Closes the Breech

After the piece has been fired (after lanyard is removed in manual firing), assistant gunner disengages the breechblock operating lever catch. He pulls the breechblock operating lever downward to the horizontal and turns the operating lever in an arc to the right until the breech is fully open. He then inspects the chamber and bore; if clear, he announces BORE CLEAR. To close the breech, the above process is reversed.

49. Receives Projectiles (155-mm Gun Only)

Assisted by No. 1, the assistant gunner, standing on the lower rear current door, bends down and grasps the right carrying handles of the loading tray as it is lifted by No. 3 and No. 4. The assistant gunner and No. 1 set the loading tray on the rear lower turret door to the left of the rammer-spade hoist motor housing.

50. Rams Projectiles

After a projectile is placed on the lower loading trough against the rammer chain head, the chief of section will signal the assistant gunner to ram the projectile by making a horizontal sweeping motion with his left arm in the direction of the breech. On receipt of this signal, the assistant gunner will rapidly move the rammer power selector lever into the RAM position. As soon as the projectile is firmly seated, the assistant gunner will rapidly move the selector lever to the RETURN position to retract the rammer chain.

51. Operates Safety Fire Switch

After No. 1 inserts the primer in the firing lock, the assistant gunner pushes the red safety fire switch, located on the right trunnion, to the ON position. He makes a check to see that

the light, located on the Auxiliary panel, is burning.

52. Operates the Ammunition Hoist

After insuring that the front track and the rear track are locked in alinement, No. 1 operates the ammunition hoist controls to move the hoist down to a level where No. 3 can easily reach them. No. 3 relieves No. 1 in the operation of the hoist and connects the shot tongs of the hoist to the fuzed projectile. After the projectile is connected to the shot tongs, No. 3 raises the ammunition hoist to a level where No. 1 can relieve him. After No. 1 relieves No. 3 of the controls, he moves the hoist so that the projectile is positioned on the loading trough with its base against the rammer drain head. No. 1 disengages the shot tongs and raises the hoist vertically to move it out of the way. The ammunition hoist must not be on the rear track when the piece is fired.

53. Inserts the Propellant into the Chamber

As the projectile is rammed by assistant gunner, No. 1 receives the prepared powder charge from No. 2. No. 1 then inserts the powder charge into the breech from the left so that the igniter pad is 3 inches within the chamber.

54. Operation of the Firing Lock

Pull the firing lever rearward by means of a lanyard, attached to the lever at the hole drilled in the end of the lever, thereby retracting the joke. As the joke is drawn back, the sear bears against the rear shoulder of the slot in the hammer, retracting it along with the cup. As the yoke nears the limit of its retraction, the boss of the case cams the sear upward allowing the expansion of the firing spring to drive the cup and hammer forward to knock the firing pin into the primer.

55. Fires the Piece Manually

When directed by the chief of section, No. 1 prepares the firing lock for mechanical operation by cocking the firing lock, attaching a

lanyard to the trigger, placing the safety lever in the fire position, and indicating to the chief of section that the piece is ready to be fired. At the chief of section's signal or command, No. 1 grasps the handle of the lanyard with his right hand and pulls strongly with a quick steady movement to the left rear. Immediately after firing, No. 1 detaches the lanyard. In case of a misfire, the instructions contained in AR 385-63 will be followed.

56. No. 2, List of Duties

- a.* Lowers the loading trough.
- b.* Raises the loading trough.
- c.* Cleans the obturator spindle vent.
- d.* Swabs the powder chamber and inspects the bore after each round.

57. Lowers the Loading Trough

After the breech has been opened at loading elevation, No. 2 grasps the loading trough handle and pulls it out to free the detent from the hole in the loading trough. He then pushes the handle forward and allows the loading trough to lower into its extended position.

58. Raises the Loading Trough

As soon as No. 1 has inserted the propellant into the chamber, No. 2 pulls out on the loading trough handle and lifts the loading trough into its stowed position, making certain that the detent in the handle seats itself in the hole in the trough.

59. Cleans the Obturator Spindle Vent

No. 2 cleans the primer vent when possible and during lulls in firing with the vent cleaning tools.

60. Swabs the Powder Chamber and Inspects the Bore After Each Round

After each round, No. 2 swabs out the powder chamber immediately after No. 1 opens the breech. The rear of the bore, including the forcing cone, is swabbed with a water-soaked swab which may be improvised by wrapping burlap around one end of a rammer

staff section. After swabbing between rounds and before reloading the piece, No. 2 inspects the bore for damage to the tube, burning fragments of powder bags, or other objects. Any burning fragment of other objects in the bore must be removed before reloading. If bore is clear, No. 2 calls out "Bore clear." Any damage to the bore must be reported to the chief of section immediately.

61. No. 3, List of Duties

- a.* Fuzes or changes fuzes of projectiles.
- b.* Sets the fuze setter M26 or M28.
- c.* Sets fuzes.
- d.* Removes fuzes from projectiles.
- e.* Assists No. 1 in operating the ammunition hoist.
- f.* Assists in carrying the projectile.

62. No. 4, List of Duties

- a.* Sets out aiming posts.
- b.* Prepares propellant charges.
- c.* Passes propellant charge to No. 1.
- d.* Calls out the number of the charge.
- e.* Assists in carrying the projectile.

63. No. 5, Through 8, List of Duties

- a.* Loads and unloads ammunition from section vehicle.
- b.* Prepares ammunition for firing.
- c.* Determines powder temperature.
- d.* Assist in carrying projectiles.

64. Driver, Motor Carriage, List of Duties

- a.* Shifts the carriage.
- b.* Performs maintenance in stabilized situations.
- c.* Assists No. 4 in preparing powder charges.

65. Driver, 5-Ton Truck

- a.* Performs preventive maintenance.
- b.* Performs other duties as may be prescribed by the chief of section.

CHAPTER 6

FIRING BY DIRECT LAYING

Section I. TECHNIQUES OF FIRE

66. General

a. Firing by direct laying is a special technique that requires a high standard of training. The section must operate as an independent unit. Training in direct laying is based on the technique involved in indirect laying. Targets taken under fire in direct laying are usually those capable of returning fire at pointblank range; therefore, the speed and accuracy required in indirect laying become even more important for direct laying missions.

b. For additional information on direct laying, see FM 6-40 and FM 6-140.

67. Preparation of a Range Card

a. The chief of section is responsible for defense in his assigned sector, but he should be prepared to fire on targets in other sectors.

b. As soon as possible after occupation of position, the chief of section measures or estimates the ranges to critical points in likely avenues of approach for enemy tanks and vehicles and prepares a range card (fig. 12) on which he notes the ranges and elevations for quick reference.

c. If there are no prominent terrain features, stakes may be driven into the ground at critical points for references. As time permits, the range card is improved by replacing estimated ranges with more accurate ranges obtained by firing, pacing, taping, vehicle speedometer reading, map measurement, or survey.

68. Field of Fire

The sector of fire for the section should be cleared of all obstructions that might endanger battery personnel when the piece is fired or that might hinder observation. Care should be taken not to reveal the location of the position.

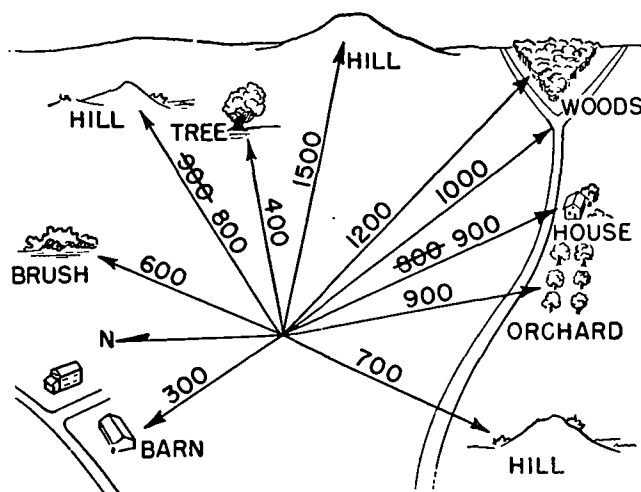


Figure 12. Range card for direct laying.

69. Targets

Targets for direct laying usually consist of vehicles, tanks, and personnel threatening the battery. Enemy personnel, whether alone or accompanying tanks, will seldom present themselves as a clearly defined target. Normally, attacking troops, using all available cover, reveal themselves only fleetingly. Accordingly, fire is conducted on the area containing the attackers rather than on the individuals. Tanks usually attack in group and may be accompanied by infantry. Normally, first priority is given to attack of those targets within the assigned sector of the weapon and second priority to targets in other sectors. Priority within the assigned zone is given to—

- Tanks at short ranges, threatening to overrun the position.
- Hull-down, stationary tanks covering the advance of other tanks.
- The commander's tank, if identified.
- The tank nearest cover, which may disappear and reappear at unexpected places.

e. The rear tank of a column moving across the front of the position, to minimize the possibility of attracting attention of the tank column to the battery position.

70. Ammunition and Fuzes

a. *General.* For close-in fires, a variety of fuzes are available (TM 9-1300-203). For high-explosive shell, the highest charge is used habitually for speed, ease in adjustment, imparting forward motion to fragments, and more effective fuze action. The flat trajectory resulting from the use of the highest charge coupled with dug-in guns may make extremely close-in firing impossible, since projectiles may not detonate on impact. At ranges of 200 to 400 meters, fuzes may fail to function on hard, flat ground. However, preparation of sectors of fire will remedy this situation. The terrain may be prepared for direct fire by placing mounds of sandbanks, dirt, or logs in the sector of responsibility. When direct fire is placed on these points or other previously selected points, as they are approached by an attacking force, the necessity for adjusting fire is reduced.

b. *Ammunition.* Only high-explosive (HE) ammunition is used. Shell, HE, is ideally suited for antipersonnel fire and is effective against vehicles and tanks.

c. *Fuzes.* High explosive shells may be fuzed with fuzes quick, delay, time, concrete piercing, or variable time. Fuze quick is the most desirable fuze to use with HE shell for close-in fires. It is highly effective and, since no fuze setting is required, is much faster to use. The time required to set the fuze and to adjust the point of impact for maximum ricochet effect makes fuze delay less desirable than fuze quick. If fuze delay is used for ricochet effect, the point of impact is adjusted 10 to 30 meters short of the target; if less than 50 percent of the bursts ricochet, fuze quick should be used. Fuze time is the least desirable type of fuze for close-in fires. Because of the wide range dispersion resulting from variations in time of burning with short fuze settings, fuze time should be used only for ranges greater than 1,000 meters. The area covered effectively by air and ricochet bursts are similar. Concrete piercing fuze with shell HE should be used

against concrete pillboxes or fortifications.

71. Trajectories

Trajectory characteristics change with the type of ammunition and the charge fired. The following trajectory characteristics govern conduct of fire for the 8-inch howitzer when the highest charge is used.

a. *Ranges From 0 To 400 Meters.* Within these range limits, the trajectory will be flat enough to prevent an 8-foot tank from passing safely under it. Fields of fire and terrain allowing the upper range limits for the ammunition and charge used are the ideal at which to open fire. Fire can then be conducted over the maximum time without misses, if deflection is correct. Also, there is less risk of obscuring the target with the smoke from a short burst.

b. *Ranges From 400 To 1,300 Meters.* These range limits include the zone in which the trajectory is sufficiently flat to permit direct estimation of range without actually bracketing the target. If there is little dispersion and a round fired at the upper range limit hits the bottom of an 8-foot tank, adding of a 100-meter range change will result in a round which will just brush the top of the tank. During adjustment within this zone, range changes should seldom be more than 100 meters and range changes of 50 meters will frequently be sufficient. The upper limits mentioned herein are the greatest ranges at which fire should be opened unless tactical conditions require otherwise. A trained howitzer crew should obtain a hit with the second shot.

c. *Ranges From 1,400 To 2,300 Meters.* This zone includes the ranges at which hits are only reasonably possible. A bracket is normally established to obtain adjustment in this zone. Since there is more dispersion in this zone, fire should not be opened at these ranges unless surprise is not important. Indirect fire will usually give better results at these ranges against stationary targets or slow moving targets such as infantry.

d. *Ranges Over 2,300 Meters.* At these ranges, direct laying is not advisable against moving targets. Dispersion is the controlling factor. Ranges must be known or determined by bracketing. At these ranges, the slope of

fall of the projectile becomes so great that a hit on a moving target is very difficult to obtain.

72. Vertical Displacement Tables

Vertical displacement is the change in the

point of burst (up or down) between two rounds fired with different ranges at an up-right target. The vertical displacements for a 100-meter range change at various ranges are shown in table IV for the 8-inch howitzer and in table V for 155-mm gun.

Table IV. Vertical Displacement per 100-Meter Range Change, 8-Inch Howitzer M55

Range (meters)	Displacement feet, shell HE, charge 7	Remarks
100	.5	Start firing using 400-meter range setting.
200	1.0	
300	1.5	
400	2.0	Start firing with estimated range.
500	2.5	
500	3.0	
600	3.5	Increase or decrease by multiple of 50 or 100 meters.
700	4.0	
800	4.0	
900	4.5	Bracketing not necessary.
1,000	5.0	
1,000	5.5	
1,200	6.0	
1,300	6.5	
1,400	7.0	
1,500	7.5	Bracket target (get bursts over and short) to obtain hit.
1,500	8.0	
1,600	8.5	
1,700	9.0	
1,800	9.5	
1,900	10.0	
2,000	10.5	
2,100	11.5	
2,200	12.0	
2,300	12.5	At ranges over 2,300 meters using shell HE, charge 7, direct laying is too inaccurate to be issued against moving targets.

*Table V. Vertical Displacement (Feet) per 100-Meter Range Change
(155-mm Gun)*

Range (meters)	Displacement, feet, shell HE, M101, super charge	Remarks
100	0	Start firing, using 600-meter range setting.
200	0.5	
300	0.5	
400	1.0	
500	1.0	
600	1.0	Start firing, using estimated range. Increase or decrease by 50- or 100-meter changes. Bracketing not necessary.
700	1.5	
800	1.5	
900	2.0	
1,000	2.0	
1,100	2.0	Start firing, using estimated range. Increase or decrease by 50- or 100-meter changes. Bracketing not necessary.
1,200	2.5	
1,300	2.5	
1,400	3.0	
1,500	3.0	
1,600	3.0	
1,700	3.5	
1,800	3.5	
1,900	3.5	
2,000	4.0	
2,100	4.5	
2,200	4.5	
2,300	4.5	
2,400	5.0	
2,500	5.3	
2,600	5.6	
2,700	5.8	
2,800	6.1	
2,900	6.2	
3,000	6.5	
Over 3,000		At ranges over 3,000 meters, direct laying is too inaccurate to be used against moving targets,

Section II. DUTIES OF CHIEF OF SECTION

73. List of Duties

- a. Conducts the fire of his piece.
- b. Identifies or selects the target.
- c. Estimates the range to the target.
- d. Determines the lead in mils.
- e. Gives initial commands.
- f. Gives subsequent commands based on observed effect.

74. Conducts the Fire of His Piece

The chief of section conducts the fire of his piece when the executive commands TARGET

(so-and-so). FIRE AT WILL, or simple FIRE AT WILL.

75. Identifies or Selects the Target

If the executive designates an object or one of a group of objects as the target, the chief of section must correctly identify the target. If the target is a group of tanks or other objects, the chief of section selects the one that, in his estimation, is the greatest threat to his own position or the position of the supported troops. He repeats the identification to his section, using the minimum number of words, such as LEAD TANK or MOVING TANK.

76. Estimates the Range to the Target

Range cards (fig. 14) with accurately measured ranges to key points provide the best means for determining the initial range. If a range card has not been prepared, the range is estimated.

77. Determines the Lead in Mils

The appropriate lead in mils for targets moving at various speeds for firing with the maximum charge is as follows:

Lateral speed	Lead (mils)	
	8-inch howitzer	155-mm gun
Under 10 MPH	5	5
10 MPH or over	10	5

78. Gives Initial Commands

The chief of section gives fire commands containing the following elements in sequence:

a. Designation of Target. The command is TARGET (so-and-so). Identification must be clear and unmistakable and should be expressed in the minimum number of words.

b. Projectile, Charge, and Fuze. The chief of section selects the appropriate projectile, charge, and fuze and commands SHELL (such-and-such), CHARGE (such-and-such), if applicable, and FUZE (such-and-such).

c. Lead. The command is LEAD (so much). See paragraph 100 for the method of determining lead.

d. Method of Fire. Fire is continuous unless otherwise commanded. In continuous fire, the piece is loaded and laid as rapidly as possible and fired at the command of the gunner.

e. Range or Quadrant. The command is RANGE (so much) or QUADRANT (so much). The range commanded by the chief of section is that range to be on the sight reticle of the direct fire telescope. For determining range, see paragraph 76.

79. Gives Subsequent Commands Based on Observed Effect

a. The chief of section gives the following commands based on observed effect:

- (1) *Change in lead.* During adjustment, the lead in mils is changed by the command RIGHT (LEFT) (so much).
- (2) *Change in range.* During adjustment, the range is increased by the command ADD (so much) and is decreased by the command DROP (so much).

b. When the breechblock is closed, the chief of section gives further changes in firing data based on movement of the target during the time required for loading.

Section III. DUTIES OF REMAINDER OF SECTION

80. Gunner, List of Duties

(Detailed description of duties, para. 79-84.)

- a.* Levels cant correction level vial.
- b.* Lays for direction and elevation on a stationary target.
- c.* Takes the proper lead and range on a moving target.
- d.* Fires the piece.
- e.* Continues tracking the target.
- f.* Applies corrections for lead and range.

81. Levels Cant Correction Level Vial

The gunner levels the cant correction level

vial by rotating the cant correction knob. This brings the telescope reticle pattern into plumb, correcting for cant when the motor carriage is parked on a slope.

82. Lays for Direction and Elevation on a Stationary Target

When firing directly at an immobile target, the gunner, sighting through the direct laying telescope, traverses the tube until the vertical line in the telescope reticle appears on the center of the target (at close ranges, on a port, slit, or some other vulnerable point of the target).

83. Takes the Proper Lead

When the chief of section commands LEAD

(SO MUCH), the gunner, sighting through the direct laying telescope, traverses the piece so that the target appears in the reticle traveling toward the vertical center line at the correct range (fig. 13). The lead expressed in mils determines the distance between the center of the target and the vertical center line. The gunner maintains this lead continuously until the target is immobilized or the chief of section announces a change. Tracking is best accomplished with low speed power if the mechanism is in smooth operating condition. If tracking is jerky, manual traverse should be used.

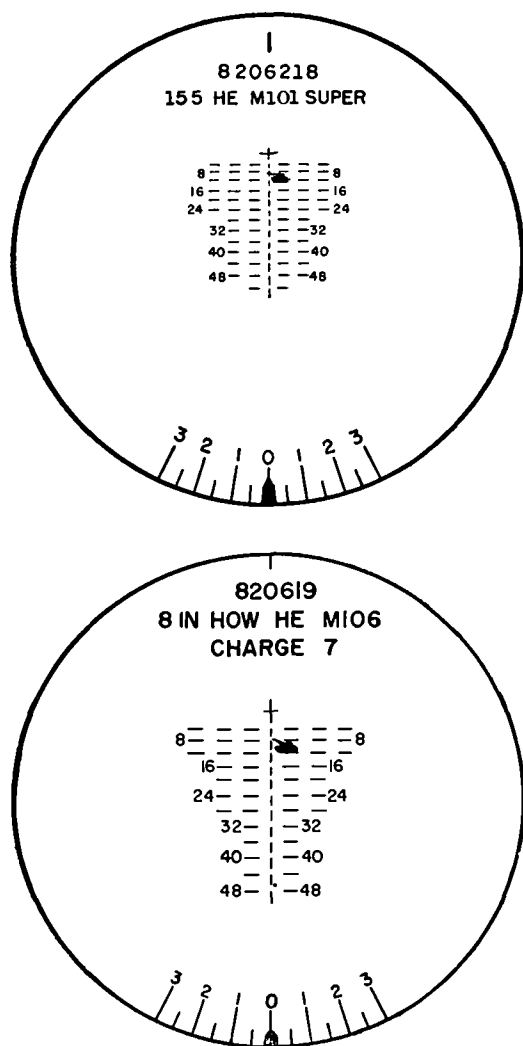


Figure 13. Gunner's sight picture, direct laying telescope; lead 5 mils, range 1,200 meters.

84. Fires the Piece

To fire the piece the gunner takes those actions prescribed in paragraph 55.

85. Continues Tracking the Target

The gunner continues to track the target until CEASE FIRE is given.

86. Applies Corrections for Lead

The gunner applies the chief of section's command for changing the lead and range (para. 79).

87. Remainder of Section

a. Cannoneers. Except as indicated in *b* below, the remainder of the section perform duties as prescribed for indirect laying.

b. Driver, Motor Carriage. The driver takes his post in the driver's compartment, starts the engine, and prepares to shift the vehicle as directed.

CHAPTER 7

MISCELLANEOUS PROCEDURES AND TECHNIQUES

88. Precision in Laying

a. Sighting and laying instruments, fuze setters, and elevating and traversing mechanisms must be properly operated to reduce the effects of lost motion. For uniformity and accuracy, the last motion in setting the instruments must be from lower to higher numbers; final motion of the elevating handwheel must be in the direction of more difficult movement, and final motion in traversing must be from left to right. Personnel who lay the piece must be required to verify the laying after the breech has been closed.

b. When a bubble is centered, the line of sight must be at a right angle to the scale or level vial to prevent parallax errors. Bubbles must be centered exactly.

c. For uniformity and accuracy in laying on aiming posts, the vertical crosshair in the reticle of the panoramic telescope must be alined with the left edges of the aiming posts.

89. Aiming Points

a. *General.* After the piece has been laid initially for direction, it is referred to the aiming posts and usually to one or more distant aiming points as described in paragraph 41. An aiming point must have a sharply defined point or vertical line which is clearly visible from the piece, so that the crosshairs of the panoramic telescope can be alined on exactly the same place each time the piece is relaid.

b. *Distant Aiming Point.* A distant aiming point is one at sufficient distance so that normal displacements of the piece in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth counters) of more than one-half mil. This distance should be at least 3,000 meters. The executive officer usually designates the distant aiming point or points to be used.

90. Aiming Posts

a. Two aiming posts are used for each piece.

Each aiming post is equipped with a light for use at night. The most desirable distance from the piece to the far aiming post is 100 meters, considering accuracy of laying, visibility, and ability to control the aiming post lights. First, the far aiming post is set up and alined. The near aiming post is then set up at the midpoint between the far aiming post and the panoramic telescope and is alined by the gunner so that the vertical crosshair of the telescope and the left edge of the two aiming posts are in alinement. To insure equal spacing of aiming posts, the distances to both the near and far aiming posts should be paced by the same man. If ground conditions make pacing inaccurate, the distances from the piece to the aiming posts may be measured by using the panoramic telescope, with the aiming posts as measuring devices (*d* below).

b. For night use, the aiming post lights should be adjusted so that the far light will appear several feet above the near light. On flat terrain this may be accomplished by using only the lower half of the near aiming post. The two lights placed in this way will establish a vertical line for laying the piece.

c. Since the panoramic telescope is mounted at considerable distance from the center of rotation of the top carriage, large changes in deflection will cause misalinement of the aiming posts. Placing the aiming posts to the left front when the piece is in the center of traverse will keep this misalinement to a minimum and still allow maximum visibility.

d. To measure the distance from the piece to the aiming posts, the stadia method may be employed by using the panoramic telescope and the aiming posts as measuring devices. No. 4 cannoneer, in setting out the aiming posts, holds the upper section of one of the aiming posts in a horizontal position, perpendicular to the line of sighting. The gunner measures the length of this section in mils using the reticle of the panoramic telescope. For example

the upper section of the aiming post is $4\frac{1}{2}$ feet long and measures 14 mils when it is 100 meters from the piece. The proper location for the near aiming post, in this case, would be the point at which the $4\frac{1}{2}$ -foot section measures 28 mils. In many cases, the ideal spacing of 50 and 100 meters cannot be obtained, but the aiming posts will be properly spaced when the near aiming post is set at a point where the $4\frac{1}{2}$ -foot section measures twice the number of mils it measured at the far aiming post location. This measurement may be performed at night by attaching the night lighting devices at the $4\frac{1}{2}$ -foot marks on the aiming posts.

91. Correction for Displacement of Aiming Posts

When the gunner notes that the vertical line of the telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the piece so that the far aiming post (light) appears exactly midway between the near aiming post (light) and the vertical crosshair (fig. 14). If the displacement is due to traversing the piece, the gunner continues to lay as described above. If the displacement is due to progressive shifting of the carriage caused by the shock of firing, or other cause, the gunner will notify the chief of section, who, at the first lull in firing, will notify the executive and request permission to realine the aiming posts. To realine the aiming posts, the piece is laid with the far aiming post midway between the near aiming post and the vertical crosshair (fig. 14). The far aiming post is moved into alinement with the vertical crosshair of the telescope and then the near aiming post is alined. If terrain conditions make it impracticable to move one of the two aiming posts, the piece is laid for direction and

referred to the aiming post that cannot be moved. The other post is alined by using the method described in paragraph 90, and the azimuth reset counter is turned to 3200.

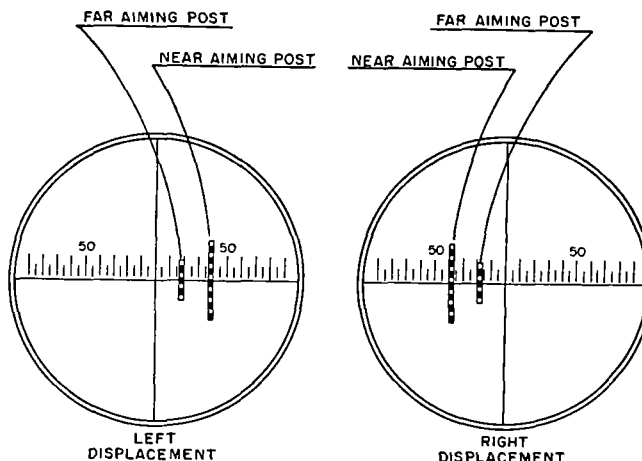


Figure 14. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

92. Testing Targets

Testing targets will be more useful if the following improvements are made:

- The target should be mounted on a flat piece of masonite, wallboard, or similar material.
- To insure stability of the testing target throughout bore-sighting, it should be fastened securely to a stand.
- For use in either leveling or canting the testing target, a mil scale may be inscribed at the bottom of the target. A small nail at the top marks the center from which an arc was drawn and provides a hook from which to suspend the plumbline.

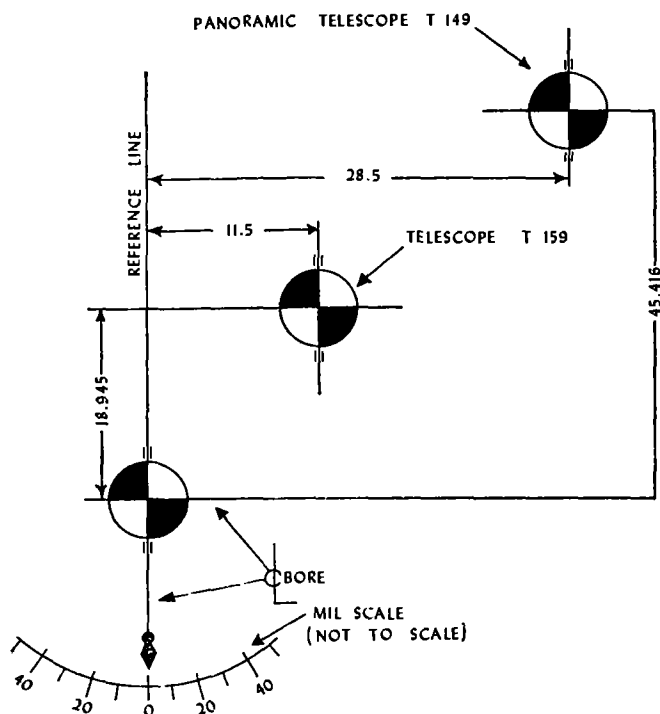


Figure 15. Testing target with mil scale and vertical reference lines.

d. A vertical reference line (fig. 15) may be drawn through the center of each diagram. These lines may be used when the trunnions cannot be leveled by setting the testing target with the cant angle of the piece. The target is tilted until the line of sight through the tube tracks between the tube reference line when the tube is elevated or depressed. Then the panoramic telescope is adjusted so that its vertical crosshair tracks between the appropriate reference lines when the tube is elevated or depressed.

e. To facilitate boresighting in darkness, a $\frac{1}{16}$ -inch hole may be bored through the mounted testing target at the center of each aiming diagram. A flashlight held against the target behind the appropriate hole provides an aiming point for use in blackout conditions. Patches of felt padding should be fastened on the back of the target covering the regions of each hole, so that light from the flashlight will not escape. The flashlight must be lit only after it is placed firmly in position. Care must be taken to prevent disturbing the position of the testing target.

f. If the proper testing target is not available, a substitute with aiming diagrams for the bore and panoramic telescope may be constructed in accordance with the dimensions shown in TM 9-2350-210-12.

93. Cease Firing

The command **CEASE FIRING** is normally given to the section by the chief of section, but in emergencies anyone present may give the command. At this command, regardless of its source, firing ceases immediately. If the piece is loaded, the chief of section reports that fact to the executive. The executive acknowledges this announcement by saying "number (so-and-so) loaded." If **CEASE FIRING** is commanded by the fire direction center, firing is resumed at the announcement of the quadrant. If **CEASE FIRING** is commanded from within the firing battery, the executive investigates the condition that caused the command to be given. When the condition is corrected, firing is resumed at the executive's command of **QUADRANT** (so much).

94. Changes in Data During Firing

If it is necessary to correct any element of firing data, all firing previously ordered but not yet executed is stopped by the command **CEASE FIRING**. Corrected data is then announced. If the piece is not loaded, the new data is set off and firing is resumed at the command **QUADRANT** (so much). If the piece is loaded and no change in the fuze setting is required or if the piece is loaded with a percussion-fuzed shell, the new data is set off and firing is resumed at the command **QUADRANT** (so much). If the piece is loaded with time-fuzed shell and a change is required in the fuze setting, the chief of section suspends firing and reports that fact to the executive; for example, "No. 2 loaded, time (so much)." The piece will not be unloaded unless directed by the executive. In continuous fire, changes in data are so applied as not to stop the fire or break its continuity.

95. To Unload the Piece

A complete round, once loaded, should always be fired in preference to being unloaded

unless military necessity dictates otherwise. The piece will be unloaded only on the specific order and under the direct supervision of an officer. To unload the 8-inch howitzer or the 155-mm gun (TM 9-2350-210-12), the command is UNLOAD, and the operation is performed as follows:

a. The chief of section has the primer and firing mechanism removed, the breech opened, the powder charge withdrawn, the chamber filled with waste, the breech closed, and the tube depressed to zero elevation.

b. Numbers 3 and 4 insert the unloading rammer into the muzzle end of the tube and push carefully until the rammer head encircles the fuze and contacts the projectile. Steadily increasing pressure is applied by tapping the end of the rammer staff with a wooden block, if necessary, to loosen the projectile.

c. When the projectile is loosened, Nos. 3 and 4 suspend operation of the rammer while the chief of section has the breech opened and the waste removed. Number 1 then places the loading trough and loading tray in position in the breech to receive the projectile. As the tube is elevated to the load position (approximately 180 mils), the chief of section, standing at the breech end of the bore, holds a section of rammer staff, if available, or a similar item, firmly against the base of the projectile. He steadies its backward movement as the assistant gunner and No. 2 push the projectile onto the loading trough.

d. After it is unloaded, the projectile is disposed of as directed by the chief of section.

e. For further information on unloading, see FM 6-140, and TM 9-2350-210-12. For instructions concerning misfires, see AR 385-63.

96. Care of Ammunition

a. To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents, care must be exercised in the storage and handling of ammunition at the battery. Provisions of TM 9-1900 applicable to field service should be followed carefully. In the field, existing conditions in each position will determine the amount of time, labor, and materials re-

quired to store and preserve the ammunition adequately. If the position is to be occupied for only a few hours, a tarpaulin spread on the ground may be sufficient; for longer periods of time, more elaborate facilities should be provided.

b. Ammunition must be protected from damage. When projectiles are received, they should be sorted into lots and placed in the best available storage. Ammunition data cards should be kept until all ammunition for that lot is expended. The eyebolt lifting plug should not be removed from unfuzed projectiles until the fuze is to be inserted. Protection should be provided against moisture, dirt, direct rays of sun and, as far as practicable, artillery fire and bombing. Protection against weather, dirt, and sun may be obtained by the use of tarpaulin and dunnage. Projectiles stacked in the open should be raised off the ground at least 6 inches. If drainage is not good, ditches should be dug around the stacks. A liberal use of dunnage should be made between layers, and covering tarpaulins should be raised at least 6 inches from the stack to insure adequate ventilation. Ammunition for the 8-inch howitzer should be stacked in a single layer and each stack should contain not more than 25 rounds. Stacks should be at least 10 yards apart.

c. Powder charges should be sorted into lots and protected from sources of high temperatures, including direct rays of the sun. More uniform firing is obtained if the charges are of the same temperature. Powder charges should not be removed from containers until just before firing.

d. Explosive elements in primers and fuzes are particularly sensitive to shock and high temperature; therefore, strict attention should be given to their care and handling. Protection and safety devices should not be removed from fuzes until just before use. No attempt should ever be made to disassemble a fuze into its components.

e. For further information on care of ammunition, see FM 6-40, FM 6-140, TM 9-1900, and TM 9-2350-210-12.

97. Section Data Board

When a position is occupied for more than

a few hours, data boards may be used by each section to record such items as deflections to aiming points, calibration correction when appropriate, minimum elevations, data for the barrage and counterpreparations, and other

data which may be needed quickly. If such information assumes a standard pattern, the section may paint a form on a convenient part of the weapon and chalk in the various items of information in the appropriate spaces.

CHAPTER 8

BORESIGHTING

Section I. GENERAL

98. Description

a. Boresighting is the process of verifying that the optical axis of the on-carriage fire control equipment is parallel with the axis of the tube of the weapon, both for deflection and for elevation. Any misalignment discovered through boresighting is corrected as described in paragraphs 99 and 104. The tube should be placed near its center of traverse prior to boresighting. All instruments and mounts must be positioned securely; there must be no free play. Boresighting is conducted before firing and, when necessary, during lulls in firing.

b. Three methods of boresighting these weapons are—

- (1) Testing target method (para. 100–104).
- (2) Distant aiming point method (para. 105 and 106).
- (3) Standard angle method (para. 107–110).

99. Equipment

The following equipment is needed for boresighting:

a. Boresights. Front and rear boresights or improvised substitutes are necessary for all but the standard angle method for boresighting. If boresights are not available, crosshairs may be fastened on the muzzle, and the obturator spindle vent may be used as a rear sighting guide.

b. Testing Target. A testing target or suitable substitute is needed for preparatory steps in testing and for certain methods of boresighting. If a testing target is not available, a clearly defined aiming point 3,000 or more meters from the piece may be used to accomplish approximately the same purpose as the testing target.

c. Tools. The section equipment includes all the necessary tools for boresighting and testing. If any item of sighting and fire control equipment fails to meet the prescribed tests, ordnance maintenance personnel must be notified.

100. Conditions

The on-carriage fire control equipment is in correct alinement when the conditions in *a* through *d* below exist.

a. Mounts and instruments are securely attached, and there is no binding or excessive backlash between the gears.

b. The lines of sight of on-carriage sighting equipment are parallel to the axis of the bore throughout the limits of elevation.

c. All scales are indexes read zero.

d. All bubbles are leveled.

101. Leveling

a. Trunnions. Although it is not absolutely necessary to level the trunnions for boresighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, because a tilt corresponding to the cant does not have to be introduced in the telescope mount and the testing target when it is used. The trunnions can be leveled by moving the carriage to level ground or by building up the standing for one of the motor carriage tracks. In no case should there be more than 20 mils of cant.

b. Plumbline. The best method to check leveling is by means of the plumbline. The line is suspended directly in front of the axis of the bore at a distance of approximately 15 feet. The line of sight should track the plumbline as the tube is depressed and elevated between minimum elevation and the limits described by

a plumbline which is as long as practicable. The plumbline must be shielded from wind currents, and the plumb bob or weight should be suspended in a container of liquid in order to keep the plumbline taut.

Section II. TESTING TARGET METHOD

102. General

The testing target method of boresighting consists of using the aiming diagrams of the testing target as aiming points. The preliminary steps in boresighting are as follows:

a. Trunnions. Level the trunnions as described in paragraph 101.

b. Tube. Level the tube by using the gunner's quadrant on the leveling plates of the breech ring. Make certain that the shoes on the gunner's quadrant are positioned between the engraved lines on the leveling plates.

c. Boresights. Open the breech and insert the breech boresight in the chamber. Attach the muzzle boresight, stretching linen cords across the witness marks and over the cords on the muzzle and securing the ends by placing a strap around the end of the muzzle. If the breech boresight is not available, the obturator spindle vent may be used.

d. Testing Target Alinement. The testing target normally should be located at least 50 meters in front of the muzzle. If the trunnions are level, level the testing target by means of a plumbline or the vertical reference lines. If the trunnions are not level, cant the target to correspond to the cant of the trunnions. In either case, the face of the target is perpendicular to the axis of the bore, both laterally and longitudinally. Without moving the piece, except for elevating and depressing slightly when using testing target reference lines, aline the tube testing target diagram with the line of sight through the tube.

e. Telescope Mount M99. The level of the locating plate is checked by insuring that the bubbles in the level segment level vials and the leveling mechanism level vials are accurately centered.

c. Gunner's Quadrant. In leveling operations in which the gunner's quadrant is used, a quadrant that has been tested and found to be accurate is required.

103. Elevation Counter

To make the elevation counter reading agree with the tube elevation, place the gunner's quadrant on the leveling plates and by elevating or depressing, bring the tube to 0 elevation. Rotate the elevation counter setting knob until the elevation vernier indexes are alined. If the counter reading does not agree with the gunner's quadrant reading within plus or minus $\frac{1}{2}$ mil, turn the elevation counter setting knob to 0, loosen the lock setscrew on the side of the bellcrank (fig. 16) and, with a $\frac{5}{32}$ -inch hex setscrew wrench, turn the bellcrank adjusting screw until the elevation vernier indexes are alined. Tighten the lock setscrew, making certain the adjustment does not change.

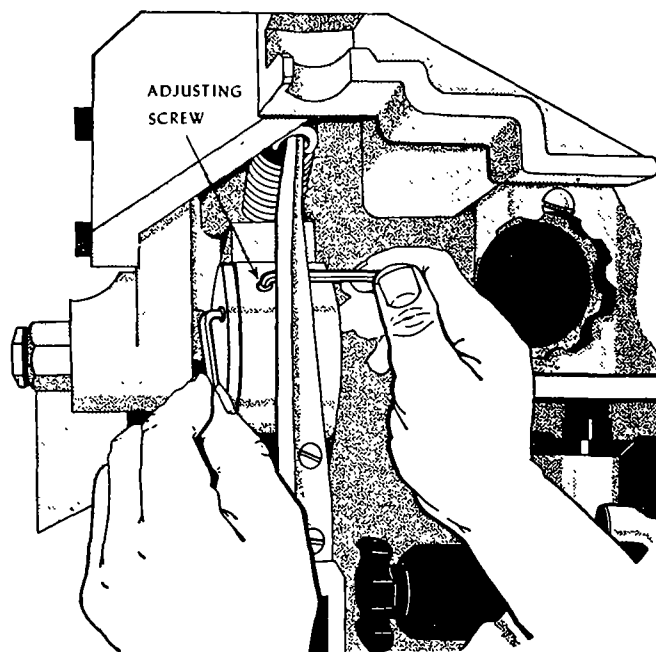


Figure 16. Bellcrank adjustment.

104. Direct Fire Telescope Alinement

After procedures prescribed in paragraph 102 are performed, check the direct fire tele-

scope to determine whether the reticle of the telescope coincides with the reticle pattern of the testing target. If it does not, adjust the boresight adjustments of the telescope mount until the reticle of the telescope coincides with the reticle pattern of the testing target. If the reticle of the telescope cannot be brought into coincidence with the reticle pattern of the testing target, the mount must be adjusted by ordnance personnel.

105. Panoramic Telescope Alinement

Rotate the elevation and azimuth knobs until the horizontal and vertical lines of the reticle pattern are alined with the horizontal and vertical lines on the panoramic telescope dia-

gram on the testing target. The coarse azimuth and micrometer scales should now read 0 within 5 mils; if they do not, loosen the 3 setscrews on the micrometer scale and slip the scale to 0 with the crosshairs of the telescope on the center of the telescope diagram. If the coarse azimuth and micrometer scales should be in error by more than 5 mils, the telescope being properly seated, adjustment must be made by ordnance maintenance personnel.

106. Periscope M15A1 Alinement

For information on procedures to be followed in boresighting the periscope M15A1, see TM 9-2350-210-12.

Section III. DISTANT AIMING POINT METHOD

107. General

The distant aiming point method consists of alining the optical axis on the on-carriage fire control equipment and the line of sight through the tube on a common point at least 3,000 meters from the piece and as near zero elevation as possible.

108. Procedure

The steps prescribed for the testing target

method apply to the distant aiming point method, except that the boresights and optical sights are alined on the same point instead of on the diagrams on the testing target. Accurate cross leveling of the trunnions is unnecessary when boresighting on a distant aiming point, because the lines of sight converge on a single point.

Section IV. STANDARD ANGLE METHOD

109. General

When existing conditions make other methods of boresighting impracticable, the standard angle method may be used. In this method, the alinement of the optical axis of the panoramic telescope parallel to the axis of the bore is tested and adjusted by referring to a selected point on the muzzle. The deflection and elevation angles necessary to refer the line of sight of the telescope to the selected point on the muzzle are referred to as the standard angles. After the standard angles have been determined, they may be used for a quick test of the alinement of the panoramic telescope when more precise methods cannot be used. Correction of misalinement, as a result of this test, should be verified by a more accurate method at the earliest opportunity. When the standard

angle method of boresighting is being used, the recoiling parts must be in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined. Therefore, the recoil mechanism must be checked to see that it contains the proper amount of recoil oil before determining the standard angles. Standard angles are usable only as long as the same tube-carriage combination is intact. If either the tube or carriage is changed, new standard angles must be established.

110. Parallax

Parallax in the panoramic telescope must be eliminated. This is done by placing in front of the eyepiece lens a dark colored cardboard or metal parallax shield of the same diameter as

the eyepiece lens housing. The shield should have an exactly centered hole $\frac{1}{16}$ -inch in diameter. A more permanent parallax shield may be constructed of brass or bronze shim stock. When the shield is constructed of metal, a series of fingers approximately $\frac{3}{16}$ -inch wide and $\frac{1}{4}$ -inch long separated by $\frac{1}{4}$ -inch spaces should extend beyond the perimeter of the shield. These fingers should be bent along the circumference of the circle to form a 90 degree angle with the surface of the shield. The fingers serve as a means of clipping the shield in place quickly and permit easy removal. If the eyepiece has a rubber eyeguard, the metal shield may be attached within the eyeguard.

111. Preliminary Operations

The ideal time to determine the standard angles for later use is after performing basic periodic tests when the trunnions are level and the panoramic telescope mount is known to be in correct alinement. Procedure for determining standard angles follows:

a. With the tube in battery, scribe lines in the paint to mark the normal positions of the parts which move in recoil with respect to parts which do not move in recoil.

b. Boresight the piece by using a testing target or distant aiming point.

c. With friction tape, fasten a bright, straight pin in the right horizontal witness mark. Allow the pin to project to the right of the muzzle (fig. 17).

d. Fasten the parallax shield over the eyepiece of the panoramic telescope.

e. Verify that the elevation counter dial reads 0 mils and that the telescope mount is level.

f. Turn the azimuth knob and elevate or depress the tube as necessary and place the crosshairs of the sight on the pin in the left horizontal witness mark of the tube.

g. Verify that the telescope mount is level and that the horizontal and vertical lines of the telescope are exactly on the junction of the pin with the muzzle.

h. Read and record the deflection from the

azimuth counter dial of the panoramic telescope to the nearest one-fourth mil. This is the standard azimuth angle for the piece tested.

i. With the gunner's quadrant seated on the quadrant seats, measure and record the elevation of the tube to the nearest one-fourth mil. This is the standard elevation angle for the piece tested.

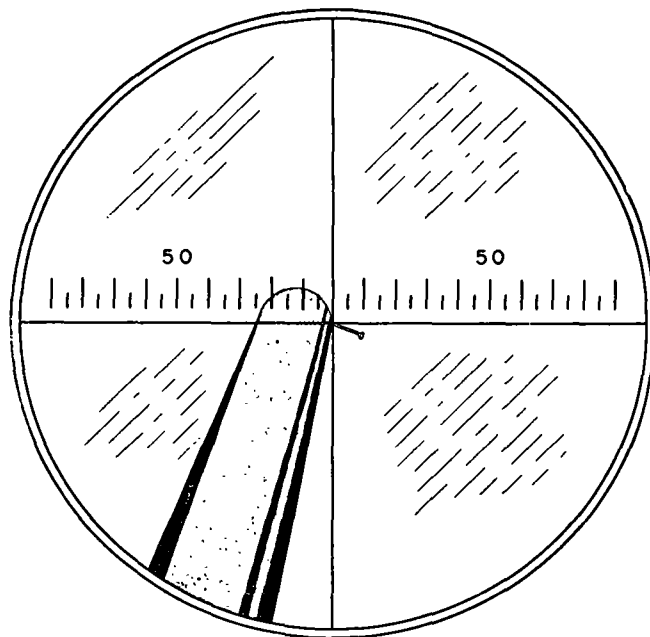


Figure 17. Sight picture of projecting pin.

112. Procedure

After the standard angles have been determined and recorded, the steps in performing the standard angle method of boresighting follow:

a. Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined. If they are not in the same position, the amount of recoil oil in the recoil mechanism must be modified until the distance from the end of the breech to the scribed line (para. 109a) is the same.

b. With the friction tape, fasten a bright straight pin in the right horizontal witness mark so that the pin projects out to the right of the muzzle.

c. Place the parallax shield on the eyepiece of the telescope.

d. Set off the standard elevation angle. (para. 111i).

e. Set off the standard azimuth angle on the azimuth counter dial of the panoramic telescope (para. 111h).

f. If the intersection of the crosshairs of the panoramic telescope is not exactly on the junction of the pin and the muzzle, the sight is out of adjustment. If the azimuth angle is in error, it may be corrected by section personnel by slipping the azimuth micrometer scale. If the elevation angle is in error by more than $\frac{1}{2}$ mil, the bellcrank adjustment must be performed.

CHAPTER 9

BASIC PERIODIC TESTS

Section I. GENERAL

113. Purpose

Basic periodic tests are performed—

a. To determine whether the oncarriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

b. By the section and the artillery mechanic under the supervision of the battery executive.

c. At the discretion of the unit commander. Suggested times are—

- (1) Once each year if howitzer is used for nonfiring training.
- (2) Every 3 months if the howitzer is fired.
- (3) As soon as possible after intensive

use, accidents, or travel in extremely rough terrain.

- (4) When fire is inaccurate for no apparent reason.

114. Preparations for Basic Periodic Tests

The following conditions must be established prior to conducting the tests:

a. Drive the motor carriage to a site that is as near level as possible.

b. Suspend a plumbline.

c. Level the trunnions by using the plumbline.

d. Boresight the howitzer by using the testing target.

Section II. TESTS OF GUNNER'S QUADRANT

115. General

The gunner's quadrant must be in proper adjustment to conduct the tests and adjustments on other sighting and fire control equipment.

116. End-For-End Test

The end-for-end test is conducted as follows:

a. Inspect the shoes on the gunner's quadrant for dirt, nicks, and burrs.

b. Inspect the quadrant seats on the breech for dirt, nicks, and burrs.

c. Zero the scales on the gunner's quadrant.

d. Place the quadrant on the quadrant seats. Depress and elevate the tube until the bubble in the gunner's quadrant is centered.

e. Reverse the quadrant on the seats and check the bubble. If the bubble recenters, the quadrant is in adjustment, and the test is complete.

f. If the bubble does not center, turn micrometer knob and try to center the bubble.

- (1) If the bubble centers, read the black figures on the micrometer scale and divide by 2. *This is correction for the gunner's quadrant.*

- (2) Place this correction on the micrometer scale, and level the tube.

- (3) Reverse the quadrant. The bubble should center.

g. If the bubble does not center as in *f* above, move the gunner's quadrant arm down one graduation (10 mils).

- (1) Turn the micrometer knob until the bubble centers.

- (2) Take the reading on micrometer scale, add 10 to it and divide the sum by 2. Place the result on the micrometer scale.

- (3) With the quadrant arm set at minus

10 and the above result on the micrometer scale, place the quadrant on the quadrant seats and level the tube.

- (4) Reverse the quadrant. The bubble should center.
- (5) Subtract the reading on the micrometer scale from 10 to obtain the error.

Note. If an error is determined during the end-for-end tests, it will be used only during the sighting tests and adjustments and will not be carried in fire missions. If the error exceeds 0.4 mil, the quadrant must be sent to ordnance.

117. Micrometer Test

The micrometer test is performed as follows:

- a. Set the radial arm to read 10 mils on the elevation scale, and set the micrometer at zero.
- b. Place the quadrant on the leveling plates with the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.
- c. Set the radial arm at zero, and set the micrometer at 10 mils.

d. Reverse the quadrant; the bubbles should center.

Note. Do not disturb the lay of the tube.

e. If the bubble does not center, the *micrometer* is in error and must be adjusted by ordnance personnel.

118. Comparison Test

The comparison test is conducted in the following manner:

- a. Compare the readings as follows:
 - (1) Take readings at low, medium, and high elevations.
 - (2) Use each gunner's quadrant in the battery.
 - (3) Use the leveling plates of a *single* piece.
- b. Compute the average reading at each elevation.
- c. Compare each quadrant reading with the average.
- d. Any quadrant differing more than 0.4 mil from the average must be adjusted by ordnance personnel.

Section III. TESTS FOR TELESCOPE MOUNT M99 PANORAMIC TELESCOPE M100

119. Purpose

The purpose of the tests for the telescope mount M99, the panoramic telescope M100 is to determine whether the automatic azimuth compensating mechanism of the telescope mount actually establishes the tube (regardless of cant) in the correct vertical plane at all elevations. These tests are performed to check the adjustment and mounting of the panoramic telescope mount, the accuracy of the level vials, and the alinement of the telescope socket. The test of the telescope mount described in paragraph 120 may be performed with the trunnions either level or canted. It reflects total errors of the entire mechanism. Because compensating errors of various parts of the mount may result in the weapon's testing out properly, the other tests specified in paragraphs 121 through 124 must be performed regardless of the result of the test in paragraph 120. The

total error found in this test may then be reduced to errors in specific components.

120. Test of Telescope Mount M99

Procedure using a plumbline follows.

- a. With the boresights in place and the tube at a low elevation, traverse the tube so that the line of sight through the tube is on the plumbline; level the telescope mount by centering both the elevation level and cross-level bubbles.
- b. Place the intersection of the crosshairs of the panoramic telescope reticle on any sharply defined aiming point and note the deflection.
- c. Elevate the tube from minimum to maximum elevation (or limit of the plumbline) in 100-mil steps. At each step, traverse the tube (if necessary) to bring the line of sight back

on the plumbline. Relevel the telescope mount in both directions and check for deviation of the line of sight from the aiming point. If the vertical crosshair is off the aiming point, it is alined on the aiming point with the azimuth knob. If the horizontal crosshair is off the aiming point, it is alined on the aiming point with the elevation knob, and the bubble displacement is noted.

d. If the vertical crosshair deviates from the aiming point by more than one-half mil from the original deflection at any elevation tested or the correction for the deviation of the horizontal crosshair causes either level bubble to move in excess of one-half vial graduation, the telescope mount is out of adjustment or improperly mounted. The weapon must be referred to ordnance maintenance personnel for adjustment or correction.

121. Test of Cross-Level Setting, Telescope Mount M99

a. Level the telescope mount M99 in both directions by centering the level bubbles.

b. Set the line of sight of the panoramic telescope at 0 with parallax shield in place.

c. Suspend a plumbline to coincide with the vertical crosshair of the telescope reticle.

d. Turn the elevation knob of the panoramic telescope through the entire range of movement. If the line of sight deviates from the plumbline by more than one-half mil, the level vials are out of adjustment and must be adjusted by ordnance maintenance personnel.

122. Test of Longitudinal-Level Setting, Telescope Mount M99

a. Level the telescope mount M99 in both directions by centering the level bubbles.

b. With the parallax shield in place, by turn-

ing the azimuth knob of the panoramic telescope, set the line of sight to 1,600 mils.

c. Suspend a plumbline to coincide with the vertical crosshair of the panoramic telescope.

d. Turn the cross level correction knob on the telescope mount through the entire range of movement. If the line of sight deviates from the plumbline by more than 1 mil, adjustment of the level vials is necessary. This adjustment must be performed by ordnance maintenance personnel only.

123. Test of Elevation Counter Synchronization

Using a gunner's quadrant that has been checked for accuracy, measure the elevation of the tube at 0, 225, 625, 1,025 and 1,155 mils by placing the gunner's quadrant on the leveling plates and leveling the bubble of the gunner's quadrant. Turn the elevation counter setting knob until the vernier indexes are alined at each elevation. Check the readings of the elevation counter against the readings of the gunner's quadrant. If the 2 readings do not agree within $\frac{1}{2}$ mil at 0 elevation and 1 mil at each of the other readings, the elevation linkage is out of adjustment and must be referred to ordnance maintenance personnel for adjustment.

124. Test for Panoramic Telescope

a. Zero the scales on the panoramic telescope M100.

b. Traverse and elevate the tube as necessary to place the panoramic telescope reticle crosshairs on an aiming point.

c. Rotate the telescope head through a complete circle (6,400 mils). The telescope crosshairs should return to within 1 mil of the aiming point.

Section IV. TEST OF FUZE SETTERS

125. General

Examine the fuze setters as follows:

a. Check for burred or dented edges—

(1) The stop that fits into the slot of the

movable time ring.

(2) The adjusting pawl which engages the notch in the fixed fuze ring.

b. Depress the adjustable pawl against its

spring to determine that the movement of the pawl is free.

c. Test the fuze setter with the fuze for which it was designed, the time scale on the fuze setter must have the same graduation as the time ring on the fuze.

126. Time Scale Test

The time scale test is performed to verify that the time set on the fuze agrees, within prescribed tolerances, with the time setting on the fuze setter. This test may be conducted during firing or as a separate test.

Warning: *Never use a fuze from a dud.*

a. The time set on the fuze should agree with the time setting on the fuze setter within one-fourth of the smallest graduation on the fuze time ring. The tolerances are—

- (1) 0.05 second for fuzes having 0.2 second graduations.
- (2) 0.125 second for fuzes having 0.5 second graduations.

b. If a fuze setting doesn't agree with the time set on the fuze setter, proceed as follows:

- (1) Repeat the test as a check with a different setting.
- (2) If the fuzes and the fuze setter still don't agree refer the instrument to ordnance.

c. Do not set any one live fuze more than twice.

d. When tests are complete, reset all fuzes to SAFE and replace the safety wire or cotter pin.

Note. Some difficulties have been encountered when setting M520 fuze by means of fuze setter M26. These difficulties are due to the raised surface and slot distortion of the fuze body incurred during renovation of the fuze. If fuze setter M26 is used and an incorrect tune setting results, reset fuze to "S" (safe) position (continue counterclockwise rotation of the lower cup to reset fuze to "S" position) by means of fuze setter M14 or M27. Fuze setter M14 or M27 will then be used to set fuze to desired time.

CHAPTER 10

MAINTENANCE AND INSPECTIONS

127. General

Systematic maintenance and inspection are essential to insure that—

- a. The howitzer section is prepared to carry out its mission immediately.
- b. Unexpected breakdowns are not experienced at a critical time when maximum performance is essential.
- c. Expensive and time-consuming repairs are reduced to a minimum.

128. Disassembly, Assembly, and Adjustment

Authorized adjustments and disassemblies to be performed by battery personnel are prescribed in TM 9-2350-210-12 and appropriate Department of the Army supply manuals. Deviation from these procedures is not authorized, except as permitted by the responsible ordnance officer.

129. Records

The principal records pertaining to the weapon are the equipment logbook, DA Form 2404, Equipment Inspection and Maintenance Worksheet, and DA Form 2407 Maintenance Request. For detailed information on the use of these forms, see TM 38-750.

130. Maintenance

Detailed instructions for maintaining the howitzer and the carriage are contained in TM 9-2350-210-12.

131. Inspections

- a. *The chief of section* should inspect his equipment *daily* and take immediate action to correct any deficiencies found.
- b. *The executive*, accompanied by the artillery mechanic, should make a *daily informal*

command inspection on different parts of the weapon and carriage.

c. *The executive* should make a thorough mechanical inspection *at least once a month* of the weapons, auxiliary equipment, tools, and spareparts.

d. Detailed instructions for inspecting the howitzer and the carriage are contained in TM 9-2350-210-12.

132. Operational Services

A daily service is performed by the driver and the crew *each day* the vehicle is *operated*. This service is divided into three parts.

a. *Before-operation service* is a brief service to determine if the vehicle is ready for operation. At this time the chief of section verifies that sufficient ammunition, rations, tools, and equipment are available and secured. A detailed list of duties is contained in table VI.

b. *During-operation service* consists of detecting any unsatisfactory performance of the vehicle. A detailed list of duties is contained in table VI.

Table VI. Duties in Inspection and Maintenance
(Located in back of manual)

c. *After-operation service* prepares the vehicle to operate again on a moment's notice. This is the basic daily service for the vehicle, and it is particularly important to detect deficiencies that developed during operation. All defects that the driver and crew cannot remedy must be reported at this time. The chief of section will resupply, as required, ammunition and rations and verify that all equipment is present. Procedures for daily preventive-maintenance services are contained in TM 9-2350-210-12. A detailed list of duties is contained in table IX.

CHAPTER 11

DECONTAMINATION OF EQUIPMENT

133. General

a. Equipment that has been contaminated with the following agents constitutes a hazard to personnel and must be removed or neutralized:

- (1) Chemical.
- (2) Biological.
- (3) Radiological.

b. Decontamination is the process of cover-

ing, removing, destroying, or changing the contaminating agent or agents into harmless substances.

c. Decontamination must be started as soon as possible in order to reduce hazards, and allow safe operation of equipment.

134. Decontamination of Toxic Chemical Agents

Table X prescribes the methods of decontamination for toxic chemical agents.

Table X. Decontamination for toxic chemical agents

Contaminated object	Preferred decontamination methods	Alternate decontamination methods	Field expedient methods
Canvas	Boil in soapy water for 1 hour. Use 5 percent solution of household bleach for V-agents. Use 5 percent solution washing soda for G-agents.	Immerse in boiling water for 1 hour. Launder by standard methods. Use DANC ¹ solution for DS2 ¹ . Use slurry ² .	Aerate (except for V-agents).
Clothing	Immerse in boiling water for 1 hour, stir, add 1 pound of soap to each 10 gallons of water. Use 5 percent solution of bleach for V-agents. Use 5 percent solution of washing soda for G-agents.	Launder by standard methods. Dry clean. Use DS2 for cotton items only.	Rub M5 ointment on small contaminated areas. Aerate (except for V-agents).
Unpainted metals	Use DS2 or DANC, then rinse or wipe with organic solvent ³ , and dry.	Wash with <i>cool</i> soapy water ³ and rinse.	Aerate.
Painted metals	Spray with DS2 or DANC solution.	Wash with hot soapy water and rinse. (Slurry may be used if it is removed within 1 hour and the surface is oiled.)	Aerate. Weather.
Instruments	Clean with alcohol (or gasoline) and apply a thin coat of oil.	Wipe with rag dampened with DANC or DS2, dry with clean rag, and oil.	Weather.

¹ These decontaminants are injurious to plastic and hard rubber and should not be used in the bore.

² Equal weights of water and chloride of lime.

³ Organic solvents (petroleum products) and water do not neutralize contaminants. Precautions must be taken to dispose of these solvents as contaminated materiel.

135. Decontamination of Biological Agents

Decontaminants and decontamination procedures for toxic chemical agents are usually effective against biological agents.

136. Decontamination of Radiological Agents

a. *Radioactive contaminants* cannot be made

safe by chemical action. They must be removed or shielded if it is impracticable to wait for natural decay.

b. *Decontamination* is the process of *reducing* the hazard by removing the contaminant or shielding against radiation. Methods are given in table XI.

Table XI. Decontamination for radiological agents

Method	Contaminated object	Technique	Remarks
Wash and scrub with water.	All nonporous surfaces (metal, paint, plastics).	Work from top to bottom and up wind.	Drainage must be controlled—water is contaminated.
Detergent (soap) solution.	All nonporous surfaces.	Heat water if possible. Rub surface and wipe dry. (Moist application is all that is desired, do not let drip.)	Rags and runoff require disposal.
Organic solvents. (Petroleum products).	All nonporous surfaces.	Immerse or wash with solvent, then wash in hot soapy water and rinse with clear water.	Vapor are toxic. Fire precautions are required.
Brushing	Porous and nonporous surfaces.	Brush, sweep, dust from equipment or clothing.	Limited control of contaminate dust. Wear protective mask.
Hot spots may be reduced by sanding, filing, or grinding. These methods are not practicable for large areas—a protective mask and gloves must be worn.			
Launder	Clothing.	Use hot soapy water and rinse with clear water.	Water requires disposal.
Bathing and scrubbing ..	Personnel.	Use brushes, running water and soap.	Continue scrubbing until contamination level is safe.

CHAPTER 12

DESTRUCTION OF EQUIPMENT

137. General

a. Tactical situations may arise in which it is necessary to abandon equipment in a combat zone. In such situations, all equipment must be destroyed to prevent its use by the enemy.

b. Equipment will be destroyed only on the authority delegated by a division or higher commander.

138. Plans

A plan will be prepared by each battery to expedite destruction of equipment. The principles are—

a. The plan must be adequate, uniform, easily executed.

b. Destroy essential parts first.

c. Destruction must be as complete as possible.

d. Destroy the *same* essential parts throughout the battery.

e. Destroy spareparts and accessories with

the same priority as those installed on equipment.

139. Methods

a. The most generally applicable methods of destruction are—

(1) *Mechanical*—Requires ax, pick, sledge or similar equipment.

(2) *Burning*—Requires gasoline, oil, or other flammables.

(3) *Demolition*—Requires ammunition or explosives.

(4) *Gunfire* — Requires artillery, rocket launcher, rifle grenades.

b. In general, destruction of essential parts, followed by burning is sufficient to render the weapon useless.

140. Reference

Detailed information on destruction of the equipment is contained in technical manual for the vehicle.

CHAPTER 13

SAFETY PRECAUTIONS

141. General

Safety precautions to be observed in training are prescribed in AR 385-63. Additional information is given in FM 6-40, FM 6-140, TM 9-1901 and TM 9-2350-210-12. The more important safety precautions are summarized in this chapter.

142. Ammunition

The following precautions must be observed when handling ammunition:

- a.* Store ammunition in the firing area so that it is protected against accidental explosions.
- b.* Keep fire and flammables out of the area.
- c.* Protect ammunition from direct rays of the sun.
- d.* Do not disassemble fuzes.
- e.* All ammunition prepared for firing must be checked to insure that—
 - (1) Powder increments are present, in the proper order and in good condition, and that the proper lot numbers are placed in correspondingly marked containers.
 - (2) Time fuzes are reset to SAFE and the safety wires are replaced.

143. Failure to Fire

If the weapon fails to fire—

- a.* Keep the weapon trained on the target.
- b.* Clear unnecessary personnel from the vicinity of the howitzer.
- c.* Make two additional attempts to fire the weapon.
- d.* Wait 2 minutes after the last attempt to fire.
- e.* Eject the primer.
- f.* If the primer does not fire, replace the primer and attempt to fire.
- g.* If the primer does fire, wait 10 minutes, open the breech; replace the propellant charge, and fire the weapon.

144. Drill and Firing

- a.* Load the weapon only when firing is imminent.
- b.* Personnel move in rear of the piece when going from side to side.
- c.* Personnel stay clear of recoil path.
- d.* Crew members should use ear plugs or cotton to protect ear drums.
- e.* A safety officer will be present during all firing in training exercises. Specific duties for the safety officer are listed in FM 6-40.

CHAPTER 14

TRAINING

Section I. GENERAL

145. Purpose

This chapter presents the minimum requirements for training the howitzer section. It includes—

- a. Information for conduct of training.
- b. Minimum training schedule.
- c. Gunner's qualification tests.

146. Conduct of Training

Section training is *conducted* by the section chief. Battery officers are responsible for preparing the training plans and for supervising their execution. The chief of section—

- a. Trains *each* member of his section to func-

tion smoothly and efficiently in *all duties* of the section.

- b. Welds the section into an effective, coordinated team, capable of functioning efficiently in combat.

- c. Emphasizes the application of prior instruction to current training.

- d. Maintains a progress card on each man to show—

- (1) Instruction attended.

- (2) Tests taken.

- (3) Remarks pertaining to progress.

- e. References: AR 611-201, ATP 6-100, FM 21-5, and FM 6-125.

Section II. MINIMUM TRAINING SCHEDULE

147. Training Periods

- a. The principles that should be followed in scheduling and preparing training periods are listed below:

- (1) Arrange periods in service of the piece drill along with other battery training to provide a balanced training program.
 - (2) Section drill should not exceed 30 minutes and be conducted in a vigorous manner.

- (3) Precede and follow howitzer drill with logically related subjects. For example, precede the drill period with tests and adjustments and follow with inspection and maintenance.

- b. Army Subject Schedule 6-3 provides uniform guidance for cannoneer training.

- c. Operational and maintenance characteristics of the weapon are referenced in TM 9-2350-210-12.

- d. The training schedule outlined above is a guide to meet minimum training requirements.

148. Schedule

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW ..	1	Organization and composition of howitzer section, general duties of individuals, and formation of howitzer section.	Para. 2, 3, 9.	Howitzer and motor carriage.
C, D, PW ..	1	Posts and posting, changing posts, and mounting and dismounting.	Para. 9-15.	Do.
C, D, PW ..	2	Prepare for action	Para. 18.	Do.
C, D, PW ..	(1-hour periods). 24	March order	Para. 24.	TOE equipment.
C, D, PW ..	(½-hour periods). 9	Howitzer drill, duties in firing by indirect laying.	Para. 19.	Do.
C, D, PW ..	(½-hour periods). 6	Howitzer drill, duties in firing by direct laying.	Para. 20-23.	Do.
C, D, PW ..	(1-hour and ½-hour periods). 2	Tests and adjustment of sighting and fire control equipment.	Para. 30-49.	Do.
C, D, PW ..	(½-hour periods). 4	Aiming post displacement correction.	Para. 26.	TOE equipment, blackboard and chalk.
C, D, PW ..	(1-hour periods). 1	Inspections and maintenance drills.	Para. 51-55.	TOE equipment.
C, D, PW ..	1	Decontamination of materiel	Para. 56-59.	Decontamination and TOE equipment.
C, D, PW ..	1	Destruction of materiel to prevent use by the enemy.	Para. 60-63.	Demolition and TOE equipment.
C, D	1	Safety precautions	Para. 64-67.	TOE equipment.
PW	16	Service practice, firing by indirect laying.	Para. 19.	Do.
PW	(4-hour periods). 4	Service practice, firing by direct laying.	Para. 20-23.	Do.
C, PW	6	Review and tests of subjects previously covered.	All previous references.	Do.

C-Conference, D-Demonstration, PW-Practical Work.

CHAPTER 15

TESTS FOR QUALIFICATION OF GUNNERS

Section I. GENERAL

149. Purpose and Scope

This section prescribes the tests to be given in the qualification of gunners. The purpose is—

a. To provide a means of determining the relative proficiency of the individual artillery soldier in his performance of his duties as a gunner. *The tests will not be a basis for determining the relative proficiency of batteries or higher units.*

b. To serve as an adjunct to training.

150. Standards of Precision

The candidate will be required to perform the tests in accordance with the standards listed in *a* through *d* below.

a. Settings must be exact.

b. Level bubbles must be exactly centered.

c. The vertical crosshair in the reticle of the panoramic telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point each time the piece is laid.

d. Final motions of the azimuth and elevations setting knobs, as well as the traversing handwheel and elevating mechanism, must be made in the appropriate direction (para. 88).

151. Assistance

The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. If a candidate fails any test because of the fault of the examiner or any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

152. Time

The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command and should not be charged for any time used by the examiner.

153. Scoring

Scoring will be conducted in accordance with the two subparagraphs entitled *Penalties* and *Credits* under each subject. If a test is performed correctly, credit will be given in accordance with the subparagraph entitled *Credit* under each subject. No credit will be allowed if conditions exist as specified in the subparagraph entitled *Penalties*. No penalty will be assessed in excess of the maximum credit for each test.

154. Preparation for Tests

The piece will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in the *Special Instructions* subparagraphs under each subject. The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready," before each test.

155. Qualification Scores

Minimum scores required for qualification in the courses follow:

<i>Individual Classification</i>	<i>Points</i>
Expert gunner	90
First-class gunner	80
Second-class gunner	70

156. Outline of Tests

Para.	Subject	No. of tests	Points each	Maximum credit
157	Direct laying, direct fire telescope	4	2	8
158	Indirect laying, deflection only	18	2	36
159	Displacement correction	1	—	4
	Part I	—	(3)	(3)
	Part II	—	(1)	(1)
160	Measuring deflection	2	4	8
161	Laying for elevation, elevation counter	3	2	6
162	Laying for elevation, gunner's quadrant ..	3	2	6
163	Measuring elevation	1	5	5
164	Measuring angle of site to mask	1	4	4
165	Sighting and fire control equipment	2	4	8
166	Materiel	3	5	15

Total credit 100

Section II. TESTS

157. Direct Laying, Direct Fire Telescope

a. Scope of Tests. Four tests (two groups of two tests each) will be conducted in which the candidate will be required to execute commands similar to those given in *c* below. Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

b. Special Instructions.

- (1) A stationary target will be placed approximately 600 meters from the piece.
- (2) The coarse azimuth and micrometer scale will be set at zero and the indexes will be matched.
- (3) The candidate will be posted as the

gunner.

- (4) The piece will be pointed so that a shift of approximately 100 mils will be required for tests 1 and 3, and it will not be necessary to shift the motor carriage for any part of the four tests.
- (5) Laying at the termination of tests 1 and 3 will not be disturbed at the beginning of tests 2 and 4.
- (6) The examiner will announce the assumed direction of the movement of the target before tests 1 and 3. The target in test 3 will be opposite that in test 1.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 3	TARGET, THAT TANK, FROM LEFT TO RIGHT LEAD, 5 RANGE 600	Centers cant correct or level bubble. Traverses tube until proper lead has been established. Places proper range line of recticle on the center of the visible mass of the target. Checks cant corrector level. Gives command FIRE, when ready, and steps clear.
2 and 4	RIGHT (LEFT) 6, ADD (DROP) 200.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

- (1) The azimuth scale has been moved from zero.
- (2) The indexes on the azimuth micrometer have been moved from zero.
- (3) The cant corrector bubble is not centered.
- (4) The lead in mils is not set properly.
- (5) The proper range line of the reticle is not on the center of the visible mass of the target.

e. Credit. Time in seconds, exactly or less than 8 8% 9
Credit 2.0 1.5 1.0

158. Indirect Laying, Deflection Only

a. Scope of Tests. Eighteen tests will be conducted in which the candidate will be required to execute commands similar to those given in *c* below. Tests 1 through 4 (and tests 5–9, and 14–18) will be executed as one series of commands.

b. Special Instructions.

- (1) Commands will not necessitate movement of motor carriage.
- (2) The examiner will select a suitable

aiming point and identify it to the candidate.

- (3) Commands for special corrections will be given *only* in the tests indicated in the examples given in *c* below.
- (4) Commands for new deflections for each test will be within the following prescribed limits:

Test No.	Maximum change (mils)	Minimum change (mils)
2 and 11	180	140
3 and 12	90	70
4 and 13	40	20
7 and 16	100	60
8 and 17	50	30
9 and 18	20	10

- (5) The piece will be laid with the correct settings at the conclusion of each test before proceeding with the next test.
- (6) For these tests, aiming posts will be set out at prescribed deflection and distances.
- (7) The examiner will designate the section number of the piece to be used and will announce, when applicable, special corrections in deflection to be applied by the candidate.
- (8) The candidate will be posted as the gunner.

c. Outline of Tests.

Test No.	Examiner commands (for example)	Action of candidate
1 and 10	SPECIAL CORRECTIONS DEFLECTION 3290 NUMBER 1, LEFT 7.	Sets deflection and applies special correction. Centers leveling bubbles. Traverse piece until vertical crosshair is on left edge of aiming posts. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
2 and 11	DEFLECTION 3153.	Sets deflection. Lays on aiming posts. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.
3 and 12	DEFLECTION 3236.	Same as test 2 above.

Test No.	Examiner commands (for example)	Action of candidate
4 and 13	NUMBER 1, RIGHT 4. At conclusion of test 4 (13) give END OF MISSION. (No time considered for this operation.)	Same as test 2 above.
5 and 14	AIMING POINT, CHURCH STEEPLE (or such-and-such), REFER.	Refers telescope to church steeple. Reads deflection on coarse azimuth and micrometer scales and calls "NUMBER 1, deflection (so much)."
6 and 15	DEFLECTION 3000, REFER.	Sets deflection on azimuth counter. Verifies that vertical crosshair of the reticle is on appropriate part of church steeple. Calls "Number 1, deflection 3000."
7 and 16	SPECIAL CORRECTIONS, DEFLECTION 3080. NUMBER 1, LEFT 7.	Steps clear. Same as test 1 above.
8 and 17	DEFLECTION 3120.	Same as test 2 above.
9 and 18	DEFLECTION 3135.	Same as test 2 above.

d. Penalties. No credit will be allowed if, after each test.

- (1) The deflection is not set correctly.
- (2) The level bubbles are not centered.
- (3) The vertical crosshair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.
- (4) The last motion of the traverse was not made to the right.

e. Credit. Time in seconds, exactly or less than—

Tests 1, 7, 10, and 16, each	12	13	14
Other tests, each	8	9	10
Credit	2.0	1.5	1.0

159. Displacement Correction

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate

will be required to execute the commands given in *c* below.

b. Special Instructions.

- (1) Aiming posts will be set out at prescribed distances.
- (2) An assistant, selected by the candidate, will be stationed near the far aiming post.
- (3) The examiner will require the candidate to lay the piece on an announced deflection and report, "I am ready."
- (4) The motor carriage or the far aiming post will then be moved so that an aiming post displacement of 5 to 10 mils occurs.
- (5) The laying of the piece at the termination of part I will not be disturbed for part II.

c. Outline of Test.

(1) *Part I.*

Examiner commands	Action of candidate
CORRECT FOR DISPLACEMENT.	Lays the piece so that the far aiming post appears midway between the near aiming post and the vertical crosshair of the telescope. Checks centering of level bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

(2) *Part II.*

Examiner commands	Action of candidate
ALINE AIMING POSTS	Records deflection on breech and announces "Deflection" (so much) recorded. Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties. No credit will be allowed for either part if—

(1) *Part I.*

- (a) The far aiming posts do not appear midway between the near aiming post and the vertical crosshair of the telescope.
- (b) The bubbles are not centered.
- (c) The last motion of traverse was not

made to the right.

(2) *Part II.*

- (a) The deflection is other than the announced deflection.
- (b) The aiming posts are not properly alined.
- (c) The vertical crosshair of the telescope reticle is not on the left edge of the aiming posts.

e. Credit. Part I, time in seconds, exactly or

less than	3	3 $\frac{1}{3}$	3 $\frac{2}{3}$	4
Credit	3.0	2.0	1.5	1.0
Part II, no time limit				
Credit	1.0	...	...	...

160. Measuring Deflection

a. Scope of Test. Two tests will be conducted in which the candidate will be required to measure and report a deflection in accordance with the commands given in *c* below.

b. Special Instructions.

- (1) The piece will be laid on aiming posts to the right front.
- (2) The examiner will select two aiming

points: the aiming point for test 1 will be within 200 mils to the left or right of the aiming posts, and the aiming point for test 2 will be within 200 mils on the opposite side of the aiming posts.

- (3) The appropriate aiming point will be designated by the examiner and identified by the candidate prior to the start of each test.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	NUMBER 1, AIMING POINT, CHURCH STEEPLE TO LEFT FRONT, REFER	Centers the level bubbles. Refers to aiming point. Checks centering of bubbles. Reads deflection on "coarse azimuth and micrometer scales and reports, "NUMBER (so and so) deflection (so much)" and steps clear.
2	NUMBER 1, AIMING POINT, WATER TOWER, RIGHT FRONT, REFER.	Same as test 1 above.

d. Penalties. No credit will be allowed if—

- (1) The level bubbles are not properly centered.
- (2) The vertical crosshair of the telescope reticle is not properly on the aiming point.
- (3) The deflection is not correctly announced.
- (4) The traversing handcrank is turned.

e. Credit. Time in seconds, each test, exactly

or less than	5	5 $\frac{3}{5}$	6	6 $\frac{3}{4}$
Credit	4.0	3.0	2.0	1.5

161. Laying for Quadrant Elevation, Elevation Counter

a. Scope of Test. Three tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below.

b. Special Instructions.

- (1) Each test will require a change of settings and the accompanying laying of the piece in elevation. (All commands will be within the limits of 200 to 400 mils on the elevation counter.)
- (2) Commands for elevation in tests 2 and 3 will not be made in multiples of 5 mils.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	QUADRANT 290.	Sets announced quadrant. Elevates or depresses the tube. Checks level bubbles. Calls "Ready."
2	QUADRANT 326.	Same as test 1 above.
3	QUADRANT 323.	Same as test 1 above.

d. Penalties. No credit will be allowed if after each test—

- (1) The elevation counter is not accurately set.
- (2) The elevation vernier is not matched.
- (3) The last motion of the tube was not in the direction in which it is most difficult to turn the elevating hand-wheel.

e. Credit. Time in seconds, exactly or less than 6-3/5 7-3/5 8-3/5
Credit 2.0 1.5 1.0

162. Laying for Quadrant Elevation, Gunner's Quadrant

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those in *c* below.

b. Special Instructions.

- (1) The gunner's quadrant will be set at zero for the first test.
- (2) Each succeeding test will require a change of quadrant setting within the limits of 30 to 60 mils.

- (3) The candidate will be posted to the left of and facing the breech with the gunner's quadrant in his hand.
- (4) An assistant, selected by the candidate, will be posted to operate the elevating handwheel.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	QUADRANT 190.	Sets elevation on gunner's quadrant and seats quadrant. Has assistant elevate or depress the tube until quadrant bubble is centered. Calls "Ready," and waits for examiner to verify laying.
2	QUADRANT 245.	Same as test 1 above.
3	QUADRANT 215.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

- (1) The quadrant elevation is not correctly set.
- (2) The quadrant is not properly seated.
- (3) The quadrant bubble is not properly centered.

e. Credit. Time in seconds, exactly or less than6 6-3/5 7
Credit2.0 1.5 1.0

163. Measuring Elevation

a. Scope of Test. One test will be conducted in which the candidate will be required to measure the elevation by means of the gunner's quadrant.

b. Special Instruction. Prior to the test the examiner will lay the tube at a selected elevation, measure the elevation, and set the gunner's quadrant at zero.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE THE QUADRANT.	Places gunner's quadrant on the quadrant seats of the breech ring. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "Number (so-and-so) quadrant (so much)," and hands quadrant to the examiner.

d. Penalties. No credit will be allowed if—

- (1) The quadrant bubble is not centered when the quadrant is properly seated.
- (2) The elevation is not correctly announced.

e. Credit. Time in seconds, exactly or less than8 9-2/5 10-3/5
Credit5.0 3.5 2.0

164. Measuring Angle of Site to Mask

a. Scope of Test. One test will be conducted in which the candidate will be required to execute the command in *c* below.

b. Special Instructions.

- (1) The piece, prepared for action, will be placed 200 to 400 meters from a mask of reasonable height

- (2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils right or left of the highest point of the crest.
- (3) The candidate will be posted at the left rear of the breech with gunner's

quadrant in his hand.

- (4) An assistant, selected by the candidate, will be posted as gunner to elevate or depress and traverse the tube as directed by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE ANGLE OF SITE TO MASK.	Sights along lowest element of the bore, and has the tube moved until the line of sight just clears the highest point of the crest. Rotates the elevation counter setting knob until the vernier is alined and elevation counter is locked. Checks centering of level bubbles. Reads elevation from elevation counter. Reports, "No. (so-and-so), angle of site to the mask (so much.)"

d. Penalties. No credit will be allowed if—

- (1) The line of sight along the lowest element of the bore does not just clear crest.
- (2) The quadrant bubble is not centered when the quadrant is properly seated.
- (3) The angle of site is not correctly announced.

e. Credit. Time in seconds, exactly or less than 15 16 17 18
Credit 4.0 3.0 2.0 1.5

165. Sighting and Fire Control Equipment

a. Scope of Tests. Two tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the prescribed tests and authorized adjustments or to describe the action taken (i.e., send to the ordnance maintenance company) if adjustment is not authorized by using personnel.

b. Special Instructions. The piece will be prepared for action with the trunnions level and the tube in center of traverse.

c. Outline of Tests.

Test No.	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT	Performs test as prescribed in paragraph 114. Calls "Error (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT	Performs tests as prescribed in paragraph 115. Calls "Quadrant micrometer is (is not) in error." States what action, if any, should be taken.

d. Penalties.

- (1) *General.* The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that

the candidate can perform the operation without wasted effort.

- (2) *Test 1.* No credit will be allowed if—
(a) The bubble of the gunner's quad-

rant does not center when verified by the examiner.

- (b) The error (one-half of the amount of the angle which was indicated when the quadrant first was reversed and the bubble centered by moving the index arm and micrometer) is not correctly announced by the candidate.
- (c) The candidate does not declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil or does not declare the quadrant serviceable if the error (necessary correction) is 0.4 mil or less.
- (d) The time to complete the test exceeds 2 minutes.
- (3) *Test 2.* No credit will be allowed if—
 - (a) The procedure is not correctly followed.
 - (b) The time to complete the test exceeds 1 minute.
 - (c) The candidate fails to report necessary action to be taken.

e. Credit. If the tests and adjustments are performed correctly within the prescribed time limits, maximum credit will be given as follows:

Test 1	4
Test 2	4
Total	8

166. Materiel Test

a. Scope of Tests. The candidate will be required to perform three tests as prescribed in *c* below.

b. Special Instructions.

- (1) *Tests 1 and 2.* For tests 1 and 2, a paulin will be placed on the firing platform for the convenience of the candidate in laying out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests. The candidate may have an assistant to aid him in lowering and lifting the breechblock.
- (2) *Test 3.* A complete set of lubrication equipment authorized for use of battery personnel, including lubrication order, will be made available on a nearby paulin. Every type of lubricant used on the piece will be available in plainly labeled containers and placed on the paulin.

c. Outline of Tests.

Test No.	Examining commands	Action of candidate
1	DISASSEMBLE BREECH AND FIRING MECHANISM.	Performs the operation as described in TM 9-2350-210-12 laying the disassembled parts on the paulin. After disassembly, identifies all parts to examiner.
2	ASSEMBLE BREECH AND FIRING MECHANISM.	Performs the operation as described in TM 9-2350-210-12.
3	PERFORM DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Using the lubrication order as a guide, selects proper lubrication equipment and lubricant and shows <i>how</i> , <i>when</i> , and <i>which lubricant</i> each lubrication point on the piece is serviced (actual lubrication is not performed).

d. Penalties.

(1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.

(2) No credit will be given if the following time limits are exceeded:

Test 1 12 minutes
Test 2 16 minutes
Test 3 5 minutes

(3) A penalty of one-half point will be assessed for each component part that is not correctly identified or is omitted in test 1. There is no time limit imposed on the identification of component parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not fami-

liar with the correct nomenclature.

(4) A penalty of one-half point will be assessed for each lubrication point missed or improperly lubricated and for each time the proper lubricating device or proper lubricant is not selected.

e. Credit.

(1) The candidate will be scored on the general merit of his work, in addition to the specific requirements in *c* above.

(2) If each test is performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	5 points
Test 2	5 points
Test 3	5 points
Total	<u>15 points</u>

APPENDIX

REFERENCES

AR 320-5	Dictionary of United States Army Terms.
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 600-73	Badges.
AR 611-201	Military Occupational Specialties.
AR 672-5-1	Awards.
AR 750-5	Maintenance Responsibilities and Shop Operation.
ATP 6-100	Army Training Program for Field Artillery Units.
ATT 6-145	Training Test for Field Artillery Battalions, Gun or Howitzer, Heavy, Towed or Self-Propelled.
ATT 6-137	Field Artillery Gun or Howitzer Battery, Heavy, Towed or Self-Propelled.
DA Pam 108-1	Index of Army Motion Picture, Film Strips, Slides, and Phono Recordings.
DA Pam 310-Series	Military Publications Indexes.
FM 5-15	Field Fortifications.
FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-25	Explosives and Demolitions.
FM 6-20-2	Field Artillery Techniques
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-125	Qualification Tests for Specialists, Field Artillery.
FM 6-140	The Field Artillery Battery.
FM 21-5	Military Training.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Nuclear, Biological and Chemical Warfare.
FM 21-60	Visual Signals.
FM 22-5	Drill and Ceremonies.
FM 23-65	Browning Machine Gun, Caliber .50, HB, M2.
FM 31-70	Basic Cold Weather Manual.
FM 55-30	Motor Transportation, Operations.
TM 3-220	Decontamination.
TM 9-238	Deep Water Fording of Ordnance Materiel.
TM 9-575	Auxiliary Sighting and Fire Control Equipment.
TM 9-1527	Gunner's Quadrants M1 and M1918 and Machine Gun Clinometer M1917.
TM 9-1590	Ordnance Maintenance: Fuze Setters, M14, M22, M23, M25, and M27.
TM 9-1900	Ammunition, General.
TM 9-1300-203	Ammunition for Antiaircraft, Tank Antitank, and Field Artillery Weapons.
TM 21-300	Driver Selection and Training (Wheeled Vehicle).
TM 21-301	Driver Selection, Training, and Supervision; Tracked Vehicles.
TM 21-305	Manual for the Wheeled Vehicle Driver.
TM 21-306	Manual for the Full-Track Vehicle Driver.
TOE 6-447E	Field Artillery Howitzer Battery, 8-Inch Self-Propelled.

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BY ORDER OF THE SECRETARY OF THE ARMY:

HAROLD K. JOHNSON,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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NG: State AG (3); Units—same as Active Army except allowance is one copy per unit.

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For explanation of abbreviations used see AR 320-50.



Table I. Duties in Preparing for Action

Sequence No.	Chief of Section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Driver motor carriage	Driver section vehicle
1	Commands PREPARE FOR ACTION. Supervises operations throughout all sequences.	Elevates tube to LOAD position after tube traveling lock is removed.	Unlock spade latches, unlock and open rear turret doors and insert locking pins in braces after spade is lowered.		Stands by spade brake.	Lays wire for intrabattery communication system from motor carriage to executive's post.	Removes direct fire telescope and muzzle covers. Unlocks, lowers, and secures tube traveling lock. Assembles aiming posts and places them near right front of motor carriage.	Unload and prepare ammunition for firing, to include projectiles, propellant charges, and fuzes, as directed by chief of section.			Guides section vehicle into position for unloading ammunition.	Allow main engine to idle at 650 RPM.	Drives section vehicle into position indicated by chief of section. Assists in unloading ammunition.
2		Procures and installs panoramic telescope, levels telescope mound, and stows travel insert in telescope case.			Controls lowering of spade. Detaches spade cable from spade.								
3	Directs driver to back vehicle until spade is flush with the ground and the spade stops are seated against the hull. Commands driver to cut engine.	Sets horizontal equilibrator.	Removes breech cover.		Positions machinegun, cal. 50 in direction of probable area of responsibility for position defense.	Procures and spreads paulin to left rear of motor carriage.	Procures and assembles unloading rammer to staff sections.					When directed by chief of section, backs vehicle onto spade. At the command of the chief of section, stops engine, puts transmission in neutral, and sets brakes. Checks auxiliary generator.	
4	Checks replenisher gages, equilibrator, and recuperator pressures.	Lays for direction, if required.	Opens breech; examines tube, breechblock, primer vent, and gas check pad; and cleans and oils parts, as required.	Places breech over to rear of motor carriage.	Lowers loading trough into position for loading.	Places primer equipment and fuze setters on paulin.	Gathers covers and places to left rear of motor carriage						
5		Bore sights piece, if time permits.	Assists gunner in bore sighting, if so directed.	Moves ammunition hoist to operating position.	Receives swab bucket and swab from No. 4.	Assists gunner in bore sighting, if testing target is used.	Passes swab bucket and swab to No. 2.					Assists in unloading ammunition or performs other duties as directed by chief of section.	
6				Receives primers from No. 4. Takes post.			Procures and passes primers to No. 1.						
7	Verifies that piece is prepared for action. Reports to executive, "Sir, No. (so and so) in order," or reports any defects that cannot be corrected without delay by the section.	Directs No. 4 in setting out aiming posts when so directed by chief of section or executive. Takes post.	Takes post.		Switches on turret ventilator, when appropriate. Takes post.	Cleans and oils fuze setter, if necessary. Takes post.	Sets out aiming posts, when so directed by gunner. Takes post.	Advises chief of section status and quantities. Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	After ammunition is unloaded, drives vehicle to point indicated by chief of section, stops engine, and performs preventive maintenance service.



Table II. Duties in Firing

Sequence No.	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5, No. 6, No. 7, No. 8	Driver, motor carriage	Driver, section vehicle
1	Directs work of section personnel all sequences.	After auxiliary generator is started, turns on hydraulic pump motor and puts traversing hydraulic motor shutoff valve in TRAV position. Lays weapon on commanded deflection.	Opens breech. Wipes chamber dry for first round, assisted by No. 2.	Moves ammunition hoist in- to position for receiving projectile.	Assists Assistant Gunner in wiping chamber dry for first round. Inspects bore; if clear, announces BORE CLEAR.	Fuzes projectiles and sets fuzes. Assists No. 1 in connecting shot tongs to projectile and raising projectile with ammunition hoist.	Prepares propellant and hands it to No. 2, when requested.	Prepare ammunition under the direction of the chief of section.	Turns on master relay switch and starts auxiliary generator. Performs other duties as prescribed by the chief of section.	Performs duties as pre- scribed by the ammuni- tion specialist.
2, 3		Elevates or depresses piece to loading elevation. Turns on scavenging com- pressor.		Raises projectile with am- munition hoist and places it on loading trough against rammer chain head.	Lowere loading trough into breech after piece is at loading elevation.	Assisted by No. 5 through No. 8, carry projectile to rear of motor carriage.		Assist in carrying projectile to rear of motor carriage.		
2 (155-mm gun only.)			Receive projectile on loading tray from No. 4 and 5 and set on lower rear door.	Picks up projectile and places it on loading trough against rammer chain head.	Receives propellant from No. 4 and passes it to No. 1 when requested.	Raise projectile on loading tray and hand it to Assist- ant Gunner and No. 1.				
3 (155-mm gun only.)				Receives propellant from No. 2.						
4		After projectile is in cor- rect position on rammer trough, signals "Ram."	At command of chief of section, rams projectile.							
5	Insures that weapon is ready to fire. Indicates to executive that weapon is ready to fire by raising arm or by announcing orally. On command of executive, commands FIRE to gun- ner and/or lowers arm.	Elevates weapon to com- manded elevation. An- nounces (signals) READY after Assistant Gunner has announced SET.	Closes breech after loading trough is raised and af- ter No. 1 has announced CLOSE. Announces SET after No. 1 has announced LOADED.	Inserts propellant into chamber and announces CLOSE. Inserts primer into firing lock after breech is closed and an- nounces LOADED.	Raises loading trough.					
6		Fires piece at command of chief of section.	Moves safety fire switch to ON position after gunner announces (signals) READY.	Removes spent primer.	Swabs powder chamber af- ter each round. Cleans ob- turator spindle vent and wipes mushroom head, when necessary. Inspects bore; if clear, announces BORE CLEAR.					
		Elevates or depresses piece to loading elevation.	Opens breech after primer is removed.							

Table III. Duties in March Order

Sequence No.	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Motor carriage driver	Driver section vehicle
1	Commands MARCH ORDER and inspects chamber to insure that piece is not loaded. Supervises members of the section throughout all sequences.	Returns tube to LOCK position after tube traveling lock has been raised to upright position.	Secures projectile rack.	Secures propellant rack and receives breech cover from No. 4.	Attaches spade hoist cable to the spade.	Picks up wire and stows communication equipment.	Passes breech cover to No. 1. Raises tube traveling lock, secures tube, and replaces muzzle and direct fire telescope covers.	Assists in loading ammunition and equipment.			Guides section vehicle into position and assists in loading equipment.	Starts engine. Sets hand throttle for warmup period at 1,000 RPM. Checks gages for proper functioning.	Drives section vehicle to position indicated by chief of section.
2		Moves auxiliary fire control panel switches to OFF position.	Insures that hydraulic rammer is in OFF position and that the rammer is in the retracted or traveling position.	Passes swab bucket, swab and primers to No. 4.	Moves ammunition trough and ammunition hoist to traveling position.		Receives swab bucket, swab, and primers from No. 1. Recovers and stows aiming posts.						Assists in loading ammunition.
3	Directs motor carriage driver to move carriage forward to unseat spade.	Removes and stows panoramic telescope and installs travel insert on telescope mount.	Replace breech cover.		Operates hoist controls and raises spade to traveling position.		Recovers, disassembles, and stows unloading rammer.					At direction of chief of section, moves motor carriage forward to unseat spade.	
4		Insures that all telescope lights are OFF.	Close and lock rear turret doors.			Secures pioneer equipment and fuze setters.							
5	Verifies that piece is prepared for traveling.	Assists chief of section in checking motor carriage and section equipment.			Secures machinegun, cal. 50, in traveling position.	Assist in loading ammunition. Fold paulin and replace on motor carriage.							
6	Reports to executive "Sir, No. (so and so) in order." or reports and defects that section cannot remedy without delay.					Take posts.							

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Table VI. Duties in Inspection and Maintenance (Before (B) Operation and During (D) halt)

Sequence No.	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	Motor carriage driver	Section vehicle driver
1	Supervises inspection by all members in all sequences.	(B) (D) Inspects for condition, functioning and security of sighting and fire control equipment.	(B) Assisted by No. 1 unfastens and removes breech cover.	(B) Assists assistant gunner in unfastening and removing breech cover; inspects for tears, wear, and broken or missing fastenings.	(B) Inspects fixed fire extinguisher.	(B) Inspects communication equipment. (D) Inspects track on left side for condition.	(B) (D) Inspects tracks on right side for condition and tension.	Checks emergency rations.	Check for proper stowage of ammunition and equipment on section vehicle and assist section vehicle driver in inspection and maintenance of the section.			(B) (D) Checks fuel, oil, and transmission levels.	(B) (D) Checks fuel in tank, notes leaks, and adds fuel. Checks oil level and adds oil, if necessary. Checks coolant level and notes any leaks. Checks tires and security of spare wheels and tires.
2	(B) (D) Checks replenisher cylinder gages to determine quantity of recoil oil and directs No. 1 to service the system, if necessary.	(B) Tests operation of traversing and elevating mechanisms (power and manual).	(B) Opens breech and checks for completeness and condition of mechanism.	(B) (D) Checks ammunition hoist and powder stowage rack for security.	(B) Checks cal. 50 machinegun and mount for cleanliness, functioning, and security. Checks stowage of machinegun ammunition.	(B) Cleans and oils fuze setters. (D) Inspects bumper springs, road wheel arms, shock absorbers and torsion bars on right side for condition.	(B) (D) Inspects bumper springs, road wheel arms, shock absorbers, and torsion bars on right side for condition.					(B) (D) Checks spare containers for contents.	
3	(B) Verifies presence of technical manuals, lubrication orders, trip ticket, driver's licenses, and accident report forms.	(B) Checks functioning of right lighting devices.	(B) (D) Checks projectile stowage rack for security.	(B) Services recoil systems if directed by chief of section.	(B) Checks operation and security of spade controls and spade. (D) Checks spare containers for contents. Assists driver in filling fuel tank.	(B) Checks operation of bilge pump and ventilating blower.	(B) (D) Checks ground under vehicle for leaks.					(B) (D) Assisted by No. 4, checks condition and operation of lights.	(B) (D) Visually inspects lamps, reflectors, horn, fire extinguisher, mirrors, paulins, tools, etc., to determine if they are in the proper place and in good operating condition.
4	(B) Verifies proper supply of gasoline, oil, water, and emergency rations.	(B) Verifies completeness of section equipment and cleaning and preserving material.	(B) Checks operation of fire warning light and power rammer.	(B) Inspects piece and mount for loose parts and cracked or broken mount for loose parts welds.	(B) Assist gunner in checking completeness of section equipment.		(B) Assists driver in checking condition and operation of lights.					(B) Starts motor. Observes instruments for normal readings during warmup.	(B) Starts engine and checks all instruments for normal readings.
5	(B) Checks section equipment for proper loading and completeness.	(B) Boresights the piece. (Boresighting should be checked after displacement and prior to firing, if time permits.)		(B) Cleans periscopes and inspects hull, towing connections, hatches and doors.	(B) Assists gunner in bore sighting.	(B) Assists gunner in bore sighting. Restows testing target.							
6	Reports to battery executive, "Sir, No. (so and so) in order," or reports any defects which the section cannot remedy without delay.	Reports, "Gunner ready."	Reports, "Assistant Gunner ready."	Reports, "No. 1 ready."	Reports, "No. 2 ready."	Reports, "No. 3 ready."	Reports, "No. 4 ready."	Reports, "No. 5 ready."	Reports, "No. 6 ready."	Reports "No. 7 ready."	Reports "No. 8 ready."	Reports, "Driver, Motor Carriage ready".	

AFTER OPERATION

1	Supervises maintenance and inspection by all members in all sequences.	Cleans and tests sighting and fire control equipment.	Cleans and lubricates breech mechanism assisted by No. 1.	Assists Assistant gunner in cleaning breech mechanism.	Cleans and lubricates tube, assisted by No. 3 and 5.	Assists No. 2 in cleaning the tube.	Inspects tracks for condition and tension.	Assists No. 2 in cleaning tube.	Check for proper stowage of ammunition and equipment on section vehicle and assist section vehicle driver in inspection and maintenance of the section vehicle.			Idles engine properly before stopping. Observes instrument and warning light while engine idles. Shuts off master switch. Checks fuel and oil levels. Looks for leaks in engine compartment. Checks spare containers for content. Checks fuel filters for leaks. Operates lights and horn (if tactical situation permits). Cleans battery, checks water level, and inspects terminals for corrosion tightness, and coating of grease. Completes vehicle operation record.	Inspects vehicle and performs maintenance as prescribed in applicable technical manual assisted by Nos. 6, 7, and 8.
2	Cleans and tests gunner's quadrant.	Cleans and tests traversing and elevating mechanism.	Inspects, cleans, and lubricates cal. 50 machinegun, assisted by No. 1.	Assists Assistant gunner in cleaning cal. 50 machinegun.									
3	Inspects recoil system and directs No. 1 to service, if necessary.	Assists chief of section in supervising maintenance by all members of the section.	Cleans, lubricates, and tests firing lock.	Cleans inside of turret.	Cleans and stows rammer staff, aiming posts, and pioneer tools.	Inspects and cleans communication equipment.	Inspects bumper springs, road wheel supporting arms, shock absorbers, road wheels, and track supporting rollers.	Checks emergency rations.					
4	Posts equipment logbook and verifies the presence of all forms and manuals.		Checks condition of fixed fire extinguisher.	Services recoil system, if necessary.	Inspects and cleans section tools and tool stowage compartment.	Cleans vision devices.	Visually inspects hull, howitzer traveling lock, turret, towing connections, and hull doors.						
5	Reports to battery executive, "Sir, No. (so and so) in order," or reports any defects that cannot be corrected without delay.						Lubricates items specified on lubrication chart.						

